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摘要集

Contents

Triangle Singularity in the Production of Tcc(3875) and a Soft Pion 1

Time evolution of global polarization within an improved microscopic approach 1

General Heavy WIMP Direct Detection 1

Probing initial longitudinal geometry and electromagnetic field with directed flows of soft and heavy flavor hadrons 2

右手中微子的对撞机寻找与轻子生成机制 2

An possible explanation for three generations of leptons and quarks and the asymmetry of number of baryons and antibaryons based on the SU(5) grand unified model with hadrons as nontopological solitons 3

Probing the Zbb anomalous couplings 3

Neutrino dipole portal at electron colliders 4

Resummation of large logarithms in cross sections at subleading power 4

Lepton pair photoproduction in peripheral relativistic heavy-ion collisions 4

Parton splitting scales of reclustered large-radius jets in high-energy nuclear collisions . 5

Prediction of \psi_0 (4360) as a moleclue of D^* \bar D_1 with J^{PC}=0^{−} 6

p_T dispersion of inclusive jets in high-energy nuclear collisions 7

N = 4 supersymmetric Yang-Mills thermodynamics to order λ^2 7

PandaX-4T 暗物质探测器超高纯氙气回收系统 8

The theoretical calculation of exclusive vector meson production at future EIC and EicC 8

Dark SHINE——Dark Photon fixed-target search experiment at SHINE Facility 9

Search for Dark Higgs at ATLAS and potential to utilize the Xbb tagger 9

Search for HH−>4b proudction and H−>aa−>4b exotic decays with ATLAS and CEPC . . 10

Vector Boson Scattering and new phenomena at LHC 10

Precise Measurements of Z+photon final states and search for anomalous neutral gauge couplings with EFT at ATLAS 10

Jet-like correlations with V^0 triggered particles in p-p and pb-pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV . . . 10

Forward Single Inclusive Jet Production in pA Collisions at Next-to-leading Order with Threshold Resummation . . . 11

Overview of intermittency analysis in heavy-ion collisions . . . 11

X(3872) Production in Relativistic Heavy-Ion Collisions . . . 12

Search for top quark FCNC interactions at ATLAS . . . 13

Constraining gluon polarization in the proton . . . 13

Unraveling Gluon Jet Quenching through J/ψ Production in Heavy-Ion Collisions . . . 13

Hard-soft tomography with event engineering in heavy-ion collisions . . . 14

The production of doubly charmed exotic hadrons in heavy ion collisions . . . 14

Axion Quality from Superconformal Dynamics . . . 15

Probing the nuclear deformation with three-particle asymmetric cumulant in isobar collisions at RHIC . . . 15

Searching QCD critical point with light-nuclei productions . . . 16

Signatures of the spin Hall effect in hot and dense QCD matter . . . 16

基于外延层硅传感器的辐照损伤机理研究 . . . 17

Deep learning jet modifications in heavy-ion collisions . . . 17

Exposing the dead-cone effect of jet quenching in QCD medium . . . 18

Probing polarized fragmentation functions in unpolarized collisions . . . 19

The Zcs states and the mixture of hadronic molecule and diquark-anti-diquark components within effective field theory . . . 19

“jet quenching at finite cheimical potentials and near the CEP ” . . . 20

Long-lived neutral scalar searches at FASER . . . 20

Probing QCD critical point and induced gravitational wave by black hole physics . . . 20

Extending Precision Perturbative QCD with Track Functions . . . 21

The R&D of ultra fast MCP-PMT . . . 21

Fluctuations of conserved charges in strong magnetic fields . . . 22

Measurement of the electroweak production of Zγ and two jets in proton-proton collisions at sqrt(s) = 13 TeV and constraints on anomalous quartic gauge couplings . . . 23

Normalization of two-particle correlation observables . . . 23

20 英寸 MCP-PMT 的磁屏蔽设计 . . . 24

A search for heavy Higgs bosons decaying into vector bosons in same-sign two-lepton final states in pp collisions at $\sqrt{s} = 13$˜TeV with the ATLAS detector 24

Quantum kinetic theory for dynamical spin polarization from QED-type interaction . . . 24

the Distribution of J/ψ under the Influence of Quark-gluon Plasma 25

Measurement of the inclusive, prompt and non-prompt J/ψ production in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV with ALICE 25

Nonuniform-temperature effects on the phase transition 26

D-wave excited cscs tetraquark states with JˆPC=1++ and 1+- 26

基于声子探测的新型钼酸盐低温晶体量热器研制 27

Study of the pentaquark states 27

高重子密度区金核-金核碰撞中的奇异强子产生/Strange hadron production in Au+Au collisions at high baryon density 28

Dark magnetic dipole property in fermionic absorption 28

Hadronic molecule $\eta_1(1855)$ and its $SU(3)$ partners 28

Gravitational waves from axion and related searches 29

The recent results of collective flow from Beam Energy Scan II at RHIC-STAR 29

Probing the valence quark region of nucleons with Z bosons at LHCb 30

Polarized vector meson production in semi-inclusive DIS 30

Recent light hypernuclei measurements from STAR experiment 31

MIP timing detector at the CMS experiment 31

Research Progress of The Glass Scintillator 31

QCD Matter in electromagnetic field 32

面向正负电子对撞机物理的时间投影室径迹探测技术 (TPC) 研究进展 32

基于闪烁光纤和硅光电倍增管的大面积宇宙线测试平台研制 33

R&D progress of high granularity HCAL for CEPC 33

相对论重离子碰撞中 QCD 物质相图的实验研究 34

J/ψ azimuthal anisotropy in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV in STAR 34

喷注物理实验综述 35

CEPC 同步辐射研究进展 35

High Precision Proton Charge Radius Experiments at Jefferson Lab 35

RHIC-STAR 能量扫描 II 中直接流的实验研究进展 36

高精度时间测量电子学技术研究进展 . . . 36

Test of a prototype Topmetal chip for N⊠DEx experiment . . . 37

R&D of a novel high-granularity crystal calorimeter . . . 38

液氩探测器关键技术研发进展 . . . 38

Chiral condensates and screening masses of neutral pseudoscalar mesons in thermomagnetic QCD medium . . . 38

[Belle report] Search for a light Higgs boson in single-photon decays of Y(1S) using Y(2S)⟶pi+pi-Y(1S) tagging method . . . 39

基于神经网络的高时间分辨 ECAL 读出电子学研究 . . . 39

Lattice QCD prediction of kaon electromagnetic form factor at large Qˆ2 up to 10 GeVˆ2. 40

Exploring Partonic Collinear Structure and Light-Cone Distribution Amplitudes by Quantum Computing . . . 41

Studies of γγ-> γψ(2S) and e+e- ->ηϕ at Belle . . . 41

Testing the standard model and searching for new physics at the Future Collider . . . 41

Recent result of quarkonium from Belle and Belle2 . . . 42

Global constraint on the jet transport coefficient via jet quenching observables in heavy-ion collisions . . . 42

Fast Simulation and Design of Muon Scattering Tomography System . . . 43

Gain Measurement of Silicon Photomultiplier . . . 43

用于 CEPC 内层顶点探测器的高计数率 CMOS 像素探测器芯片研制 . . . 44

高精度时钟与控制信号分发与同步技术研究进展 . . . 44

A systematic study for the qualitative connection between hadrons and the quark components in the nuclear modification factor . . . 45

R&D on thin-gap RPC towards production for ATLAS Phase-2 upgrade . . . 45

Quantum kinetic theory and collisional contributions to shear induced polarization . . . 46

Criticality of QCD in correlated Dirac eigenvalues . . . 46

Projected three-point energy correlator at NNLL . . . 47

EicC 上核子结构及强子物理的研究 . . . 47

Experimental Program for Super Tau-Charm Facility . . . 48

Design and Prototype Test of the Homogeneous Crystal Calorimeter for STCF . . . 48

塑料闪烁体反应堆中微子探测器 . . . 49

中子伽马多模探测器性能研究 . . . 49

Lattice QCD using Large momentum effective theory . . . 50

Factorization for weak annihilation B-meson decays . . . 50

CP properties measurement of the Higgs boson interaction with tau leptons with the ATLAS detector . . . 50

Search for scalar leptoquarks in the btautau final state with the ATLAS detector . . . 51

BEPCII 本底研究实验 . . . 51

The 3-inch PMT system in JUNO experiment . . . 52

Development of silicon interposer: towards an ultralow radioactivity background photodetector system . . . 52

Search for invisible decays and rare decays at BESIII . . . 52

(Semi-)leptonic D decays at BESIII . . . 53

Hadronic charm hadron decays at BESIII . . . 53

R value measurements at BESIII . . . 54

Recent results of Baryon electromagnetic form factors at BESIII . . . 54

Hyperon physics at BESIII . . . 54

Light Meson Spectroscopy at BESIII . . . 55

ATLAS High granularity timing detector activity at IHEP . . . 55

The production of the molecules in high energy collisions . . . 55

The Upstream Tracker at LHCb . . . 56

Plan for an upgrade Upstream Tracker at LHCb Upgrade II . . . 56

Study of the Single-Event Effect on the SALT chip . . . 56

Development of HVCMOS-based silicon tracker for CEPC . . . 57

Next-Generation Scintillation Materials: Low-Dimensional All-Inorganic Cu(I) Halides . 57

Measuring CP properties of Higgs boson interactions with τ leptons with the ATLAS detector . . . 59

低温超导探测器在低能粒子探测方面的应用探索 . . . 59

Color-octet contributions for J/ψ inclusive production at B factories in soft gluon factorization . . . 59

中国散裂中子源探测器研制进展 . . . 60

Inclusive and semi-inclusive production of spin-3/2 hadrons in e+e− annihilation . . . 60

A Novel Reconstruction Method for Atmospheric Neutrinos in Large Liquid Scintillator Detectors with Machine Learning Technique . . . 61

Lattice calculation of the $\eta_c\eta_c$ and $J/\psi J/\psi$ scattering length . . . 61

大面积陶瓷 GEM 中子探测器研究 . . . 62

The ATLAS Inner Tracker Strip Detector System . . . 62

Quality Assurance for the ATLAS Inner Tracker strip sensor . . . 62

碳化硅高时间分辨探测器 . . . 63

应用于能量分辨中子成像的探测器研制 . . . 63

The Development of 4H-SiC Detector for Fast Minimum Ionization Particle Detection . . . 63

Heavy quark potential and jet quenching parameter in a rotating D-instanton background 64

Study on ATLAS Inner Tracker strip module production rate . . . 64

Molecular tetraquarks and pentaquarks in chiral effective field theory . . . 65

Heavy flavor molecules . . . 65

News of h_c and eta_c(2S) from BESIII . . . 66

The cross-section measurements of electron-positron annihilation above 4 GeV . . . 66

Dielectron production in Au+Au collisions at $\sqrt{s_{\rm NN}} = 54.4$ GeV at STAR . . . 66

Design of the Readout Electronics for the TRIDENT Pathfinder Experiment . . . 67

CSNS 高能质子测试束实验终端的物理设计 . . . 67

单光子相机成像测量研究 . . . 68

RHIC-STAR 实验上超子整体极化和局域极化测量 . . . 68

CSNS 白光中子束线探测器系统综述 . . . 68

高摩尔百分比 10B2O3 的微通道板中子成像探测器的研制 . . . 69

Study the method for measurement of an optimized LYSO energy resolution . . . 69

Silicon module assembly and QA/QC for HGCAL upgrade . . . 70

The status of Cryogenics for the PandaX-4T and future PandaX-30T . . . 70

Measurement of Zgamma plus jets differential cross section using 139 fb-1 data collected by the ATLAS detector . . . 71

Celestial Non-Gaussianities in Collider Energy Flux . . . 71

Search for the chiral magnetic effect in collisions between two isobars with nuclear structures . . . 72

Weak radiative hyperon decays in covariant baryon chiral perturbation theory . . . 72

江门中微子实验 2 万吨液闪进展 . . . 73

ATLAS 硅微条探测器读出芯片的单粒子效应研究 . . . 73
“海铃探路者”实验中的相机刻度系统 . . . 73
A Boosted Decision Tree Model for the Positron Acceptance in the Muon g-2 Experiment 74
基于 Geant4 的海水中光子传播模拟及海水光学性质解析 . . . 74
“海铃探路者”实验中的 PMT 系统 . . . 75
低本底钛冶炼工艺研究 . . . 75
无中微子双贝塔衰变实验 NvDEx . . . 76
基于 100G 以太网和 GPU 的 4G 采样率实时信号处理系统 . . . 76
Complementary constraints on Zbb couplings at the LHC . . . 76
R&D of High pressure gaseous TPC for double beta decay . . . 77
AMS L0 硅径迹室的升级 . . . 77
基于圆柱形 μRWELL 的超级陶粲装置内径迹探测器研究 . . . 78
新一代高能量粒子对撞机超导磁体技术研究进展 . . . 78
Longitudinal flow decorrelation in ^{96}Zr+^{96}Zr and ^{96}Ru+^{96}Ru collisions within a multiphase transport model . . . 78
Performance of carbon implantation LGAD developed by IHEP and IME . . . 79
CEE 径迹探测器前端读出电子学研究进展 . . . 79
热压接 Micromegas 探测器技术及其应用 . . . 80
The High-Granularity Timing Detector module flex design and simulation for the ATLAS Phase-II upgrade . . . 80
HERD 穿越辐射探测器 TeV 能区能量标定研究 . . . 81
The analogy of LV fermion-gravity and fermion-photon couplings . . . 81
Overview of RHIC Spin Program . . . 81
大型中微子射电探测望远镜 GRAND-原型阶段数据获取系统设计 . . . 82
格点 QCD 在介子衰变辐射修正中的应用 . . . 82
费曼积分的计算方法及在电子对撞机过程中的应用 . . . 82
自举方法在形状因子计算中的应用和最大超越度原理 . . . 83
Experimental expressions of emergent hadron mass . . . 83
The W boson Mass and Muon g-2 : Hadronic Uncertainties or New Physics ? . . . 84
Latest results of a monlithic active pixel sensor prototype for the CEPC vertex detector . 84

Renormalization of the flavor-singlet axial-vector current and its anomaly in dimensional regularization . . . 85

New developments on Feynman integrals calculation . . . 85

The study of the aQGC and nTGC . . . 86

为宇宙线 muon 成像设计的基于 HTM 方法的无触发电子学 . . . 86

Delta 低能激发态的内部结构 . . . 86

未来正负电子对撞机上类轴粒子的搜寻 . . . 87

轻 + 重赝标介子半轻衰变的 DSE 研究 . . . 88

赝标介子到矢量介子的半轻转变 . . . 88

双重子系统双 beta 衰变的格点计算 . . . 88

低能和高能实验对 W' 诱发的荷电非标准中微子相互作用的限制 . . . 89

EM field produced in high-energy small collision systems within charge density models of nucleons . . . 89

B(s), D(s) to light tensor meson form factors via LCSR in HQEFT with applications to semileptonic decays . . . 90

New look at the spectrum of low-lying mesons . . . 90

Monopix：高抗辐射、高速单片集成式 CMOS 像素探测器 . . . 91

Effect of Carbon co-implantation on radiation hardness of LGAD . . . 91

Cherenkov PID detector for super tau-cham facility . . . 92

A formal notion of genericity and its application to supersymmetric Wess-Zumino models . . . 92

Development of SOI pixel sensor for the CEPC vertex detector . . . 93

AMS 实验伽马射线顶点重建算法与伽马射线极化研究 . . . 93

NTD-Ge thermistor fabrication for cryogenic bolometer application . . . 94

Spatial extent of $\Delta(1232)$ with $\pi^0\pi^0$ momentum correlations using the high-resolution EM calorimeter BGOegg . . . 94

LHCb 上奇特态的产生研究 . . . 94

LHCb 上双重味重子研究 . . . 95

Searches for rare decays and new physics at LHCb . . . 95

Study of the B -> Lc Lcbar K decay at LHCb . . . 95

Search for pentaquarks in B-meson decays at LHCb . . . 95

Observation of a resonant structure near the Ds+Ds- threshold at LHCb . . . 96

Observation of a double charged tetraquark state and its neutral partner at LHCb 96

Search for scalar leptoquarks in the $b\tau\tau$ final state in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector 96

Probing QGP Properties with Upsilons at the sPHENIX Experiment 97

IHEP-IME LGAD 传感器抗辐照特性研究 97

面向同步辐射光源图像的智能无损压缩方法 98

Check on the features of potted 20-inch PMTs with 1F3 electronics prototype at Pan-Asia 98

面向高能物理数据处理的可计算存储系统设计与实现 98

"GRAND" 数据获取电子学板的测试研究 99

质子电极化率的格点 QCD 计算 99

Pion 介子分布函数 100

Spin alignment of vector mesons in heavy-ion collisions 100

SiPM 阵列替代 PMT 用于闪烁体读出应用研究 100

Impact Parameter Dependence of Photon-Photon Scatterings in Heavy-Ion Collisions . . 101

格点计算稀有 K 介子衰变的新方案 101

The Potential to Probe Solar Neutrino Physics with LiCl Water Solution 102

Automatic High-Granularity Timing Detector Module Assembly with Gantry System . . 102

How arbitrary are perturbative calculations of the electroweak phase transition? 103

Probing the electromagnetic field with heavy quarks and leptons from the decay of Z0 in ultrarelativistic heavy ion collisions 103

基于 nMCP 的光中子成像方法 104

Explaining The New CDF II W-Boson Mass Data In The Georgi-Machacek Extension Models 105

Physics at Electron Ion Colliders 105

Introduction of DAQ System’s Firmware of Giant Radio Array for Neutrino Detection . 105

LHAASO 数据获取系统 106

JadePix-3 Monolithic Pixel Sensor Telescope: The DAQ system Developments and Recent Measurement 106

Higher twist transverse momentum dependent parton distribution functions in the MIT bag model 107

Searching for fractionally charged particles in space with DAMPE 107

Mass dimension one fermions: Recent progress 108

面向大科学装置的高性能数据流处理框架 DSNI . . . 108
中国散裂中子源中子探测器读出电子学研制进展报告 . . . 109
集体流测量新进展——从小系统到大系统 . . . 109
Explaining the b->s l l anomalies in Z' scenarios with top-FC/FCNC couplings and its implications for the W-boson mass shift . . . 110
基于 3He 管中子位置灵敏探测器的真空下低功耗读出电子学设计 . . . 110
CEPC MOST2 vertex detector module assembly with Gantry system . . . 111
Deciphering the long-distance penguin contribution to B → γγ decays . . . 111
Using machine learning methods to study aQGCs and nTGCs . . . 111
Double-charm tetraquark under the complex scaling method . . . 112
辽宁师范大学校长苑晓杰教授致辞 . . . 112
辽宁师范大学高能物理理论与实验研究中心揭牌仪式 . . . 112
高能物理分会工作报告 . . . 112
高能物理现状与展望——Snowmass 研究总结 . . . 113
LHAASO 研究进展报告 . . . 113
TeV 物理实验进展综述 . . . 113
微扰 QCD 和精确计算研究进展 . . . 113
振幅计算和有效场论研究进展 . . . 113
格点 QCD 研究进展 . . . 113
高能重离子碰撞物理综述 . . . 114
加速器最新原理和技术研究进展 . . . 114
强子物理理论研究进展 . . . 114
强子物理实验研究进展 . . . 114
未来对撞机研究进展（包括 CEPC 和 STCF） . . . 114
暗物质理论综述 . . . 114
暗物质测量 . . . 115
中微子理论进展 . . . 115
中微子实验研究进展 . . . 115
高能物理发展战略规划进展 . . . 115
Explaining the Many Threshold Structures in the Heavy-Quark Hadron Spectrum . . . 115

Lattice QCD calculation of the two-photon exchange contribution to the muonic-hydrogen Lamb shift . . . 115

Next-to-Next-to-Leading-Order QCD Prediction for the Photon-Pion Form Factor 115

Measurement of the Absolute Branching Fraction of Ds +⟶ τ+ ντ via τ+ ⟶ e+ νeντ . . 115

Model-Independent Determination of the Spin of the Ω− and Its Polarization Alignment in ψ(3686) ⟶ Ω−Ω¯ + . . . 116

Measurement of the Cross Section for e+ e− ⟶ Hadrons at Energies from 2.2324 to 3.6710 GeV . . . 116

Phase transition dynamics and gravitational wave spectra of strong first-order phase transition in supercooled universe . . . 116

Observation of a Near-Threshold Structure in the K+ Recoil-Mass Spectra in e+ e− ⟶ K + (Ds− D*0 + Ds*−D0) . . . 116

R&D of ultra-fast 8 * 8 anodes MCP-PMT . . . 116

通过多玻色子过程检验标准模型及探索超出标准模型的新物理 . . . 116

D 土 D*∓ Hadronic Atom as a Key to Revealing the x（3872）Mystery . . . 116

中国散裂中子源探测器研制进展 . . . 117

Talk 1 . . . 117

Talk 2 . . . 117

Talk 3 . . . 117

格点规范场论模拟早期宇宙一阶相变 . . . 117

Study of charmed baryons at Belle . . . 117

Time-dependent Dalitz Analysis package DAFNE and Dalitz plot analysis of D0 -> K- pi+ eta at Belle . . . 118

Probing QCD critical point and induced gravitational wave by black hole physics 118

Primordial Black Hole Dark Matter in an era of Gravitational Wave Cosmology 118

Pulsar Timing Residuals induced by Wideband Ultralight Dark Matter . . . 118

Domain walls from spontaneous breaking of discrete symmetries . . . 118

Gravitational waves from phase transitions: recent progress on the bubble expansion . . 118

Anisotropy of phase transition gravitational wave and its implication for primordial seeds of the Universe . . . 118

ADM formulation and Hamiltonian analysis of $f(Q)$ gravity . . . 119

Static and spherically symmetric solutions in $f(Q)$ gravity . . . 119

Minimal typeII seesaw leptogenesis . . . 119

Theoretical predictions for far-forward tau neutrinos at the Large Hadron Collider . . . 119

Origin of Neutrino Masses on the Convex Cone of Positivity Bounds 119

Non-unitary Leptonic Flavor Mixing and CP Violation in Neutrino-antineutrino Oscillations 119

Accidental symmetries in the scalar potential of the Standard Model extended with two Higgs triplets 120

Soft Scattering Evaporation of Dark Matter Subhalos by Inner Galactic Gases 120

Neutron star limits on neutron-mirror-neutron oscillation 120

LHAASO-KM2A status 120

LHAASO-WCDA data analysis and sky survey of VHE gamma ray sources 120

A real-time monitor for TeV Blazar with LHAASO-WCDA 120

Measuring VHE diffuse gamma-ray emission from Galactic Plane with LHAASO-WCDA 121

PeV 宇宙射线大尺度各向异性测量 121

Horizontal air showers and electron neutrino search with LHAASO-KM2A 121

AMS 高能宇宙线电子流强的最新结果 121

AMS 低能正电子时变流强测量 121

AMS 实验初级宇宙线的最新结果 121

The Time-dependent Dalitz Analysis package DAFNE and Dalitz plot analysis of D0 -> K-pi+ eta at Belle 121

Pion and Kaon Distribtuion Amplitudes from Lattice QCD 122

Double J/psi at ATLAS 122

Double J/psi at CMS 122

Study of charmed baryons at Belle 122

Status, performance and recent results of PandaX 123

使用 PandaX-4T 探测器精确测量 Xe-136 双贝塔衰变半衰期 123

Latest Results From Daya Bay 123

JUNO Neutrino Mass Ordering Sensitivity 123

Precision Measurement of Neutrino Oscillation Parameters in JUNO 123

Simulation Study of Searching for Proton Decay in JUNO 123

Prospects for Detecting the Diffuse Supernova Neutrino Background in JUNO 124

Reactor Neutrino Flux and Spectrum Evolution At Daya Bay 124

Solar neutrino physics with JUNO . . . 124
利用 PandaX-4T 实验寻找太阳 pp 中微子 . . . 124
Searches of low mass dark matter at PandaX-II and PandaX-4T experiments . . . 124
Study of accidental coincidence background in PandaX-II and PandaX-4T . . . 124
XENONnT 实验进展 . . . 125
XENONnT 实验中的偶然符合本底 . . . 125
磁单极子 . . . 125
Search for Solar ^8B Neutrino in the PandaX-4T Experiment using Neutrino-Nucleus Coherent Scattering . . . 125
Searching for absorption signal of fermionic dark matter in PandaX-4T experiment . . . 125
Search for the Cosmic Ray Boosted Sub-GeV Dark Matter at the PandaX-II Experiment . 125
Dark Matter Search in the CMB . . . 125
Data Processing in the MeV Energy Range in PandaX-4T . . . 126
江门中微子实验能量分辨率研究进展 . . . 126
江门中微子实验刻度系统研制进展 . . . 126
Multi Calorimetry in Liquid Scintillator Neutrino Detector . . . 126
Vertex and Energy Reconstruction in JUNO . . . 126
Design optimization of performance for JUNO-TAO plastic scintillator with wavelength shifter fiber . . . 126
Study on pulse shape discrimination power of plastic scintillators . . . 126
AMS 高能宇宙线正电子流强的最新结果 . . . 127
AMS 高能宇宙线电子流强的最新结果 . . . 127
AMS 反质子能谱最新结果 . . . 127
AMS 反质子时变流强测量 . . . 127
AMS 宇宙线电子与质子时变流强的测量结果与物理解释 . . . 127
AMS 实验初级宇宙线的最新结果 . . . 127
AMS 实验次级宇宙线的最新结果 . . . 127
AMS 关于第三类宇宙线的实验结果 . . . 128
AMS 原子核同位素测量的最新结果 . . . 128
AMS 实验伽马射线顶点重建算法与伽马射线极化研究 . . . 128

Orbit performance and latest result of the DArk Matter Particle Explorer . . . 128
HERD 科学研究介绍 . . . 128
大型超高能伽马源立体跟踪观测设备（LACT）计划介绍 . . . 128
Cosmic rays propagation with slow disk . . . 128
Fast Termination Shock Acceleration on Solar Flare Jet . . . 128
A study of Force-field Approach from the time-dependent spectrum of AMS02 and PAMELA. . . . 129
新一代高能量粒子对撞机超导磁体技术研究进展 . . . 129
南海中微子望远镜 – 海铃计划 . . . 129
超大规模中微子望远镜的模拟进展 . . . 129
JUNO-TAO Status and Prospect . . . 129
Observation of the high-energy reactor neutrinos . . . 129
利用液氙探测器测量反应堆中微子的相干弹性散射 . . . 129
Coherent elastic neutrino-nucleus scattering and quenching factor . . . 130
Lastest nH oscillation results from Daya Bay . . . 130
用于 CEPC 内层顶点探测器的高计数率 CMOS 像素探测器芯片研制 . . . 130
ATLAS 硅微条探测器读出芯片的单粒子效应研究 . . . 130
Design of the Readout Electronics for the TRIDENT Pathfinder Experiment . . . 130
CEE 径迹探测器前端读出电子学研究进展 . . . 131
高精度时间测量电子学技术研究进展 . . . 131
中国散裂中子源中子探测器读出电子学研制进展报告 . . . 131
基于 100G 以太网和 GPU 的 4G 采样率实时信号处理系统 . . . 131
LHAASO 数据获取系统 . . . 131
为宇宙线 muon 成像设计的基于 HTM 方法的无触发电子学 . . . 131
BEPCII 本底研究实验 . . . 131
CEPC 同步辐射研究进展 . . . 131
面向同步辐射光源图像的智能无损压缩方法 . . . 131
基于神经网络的高时间分辨 ECAL 读出电子学研究 . . . 132
面向高能物理数据处理的可计算存储系统设计与实现 . . . 132
大型中微子射电探测望远镜 GRAND-原型阶段数据获取系统设计 . . . 132

BEPCII 本底研究实验 . . . 132

Does quark-gluon plasma feature an extended hydrodynamic regime? . . . 132

高温高密 QCD 物质中守恒荷涨落性质的研究 . . . 132

Finite size and interface effects on the QCD phase trasition . . . 132

Spin polarization induced by magnetic field and rotation . . . 132

Time evolution of global polarization within an improved microscopic approach . . . 133

Sterile neutrino studies using Daya Bay, MINOS, and Bugey-3 data . . . 133

Spacer configuration optimization for RPCs based on COMSOL Multiphysics simulation 133

(Semi-)leptonic D decays at BESIII . . . 133

A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery . . . 133

Combined measurement of Higgs properties . . . 134

Resummation of large logarithms in cross sections at subleading power . . . 134

H→γγ fiducial and differential cross-section in diphoton channel with full Run2 dataset at ATLAS . . . 134

Recent Higgs measurements in diboson channels at the ATLAS detector . . . 134

Higgs properties measurements in ZZ and diphoton channels: cross sections, mass at CMS . . . 134

Measurement of the Higgs boson width in ZZ final states at CMS . . . 135

Search for a new gauge boson Z' in 4μ events with the ATLAS experiment . . . 135

Search for scalar leptoquarks in the bττ final state in pp collisions at √s=13 TeV with the ATLAS detector . . . 135

Is FCNC current hiding out with Higgs? . . . 135

Search for resonances decaying to three W bosons in proton-proton collisions at sqrt(s)=13TeV at CMS . . . 135

Search for the direct production of charginos and neutralinos in final states with tau leptons in 13 TeV pp collisions with the ATLAS detector . . . 135

CP violation in ttH and tH in multilepton channels (includes combination) at CMS . . . 136

Measurement of top-Yukawa CP and Higgs EFT in ZZ and tautau final states at CMS . . 136

Study of the CP property of the Higgs to vector-boson coupling in the VBF H → γγ channel with the ATLAS detector . . . 136

从在壳振幅到高维算符——构建有效场论中任意维数的算符基 . . . 136

Search for Higgs boson decay to a charm quark-antiquark pair in proton-proton collisions at sqrt(s) = 13 TeV at CMS . . . 136

Study of charm Yukawa couplings at the ATLAS detector . . . 137

Measurement of the Higgs boson mass in the H ⟶ ZZ* ⟶ 4l decay channel . . . 137

Measurement of boosted VH(bb) process at the ATLAS detector . . . 137

Precise Measurements of Z+photon final states and search for anomalous neutral gauge couplings with EFT at ATLAS . . . 137

Searches for electroweak production of supersymmetric particles with the ATLAS detector . . . 137

Probing heavy Majorana neutrinos and the Weinberg operator through vector boson fusion processes at the LHC CMS Experiment . . . 137

Measurement of electroweak production of Wgamma with two jets in proton-proton collisions at sqrt(s) = 13 TeV from CMS . . . 138

Search for Higgs boson pair production at CMS . . . 138

Flavor Physics at the CEPC . . . 138

Interplay & synergies between the Cosmic Frontier and CEPC . . . 138

Time of Flight measurement potential at CEPC calorimeter . . . 138

New Physics at CEPC . . . 138

Prospects of electroweakino and slepton search at CEPC . . . 138

Long-Lived Particle Search with Future Lepton Collider . . . 139

Recent Higgs measurements in diboson channels at the ATLAS detector . . . 139

Study of charm Yukawa couplings at the ATLAS detector . . . 139

Constraining the Higgs boson self-coupling from single- and double-Higgs production with the ATLAS detector using pp collisions at sqrt(s)=13 TeV . . . 139

Search for HH−>4b proudction and H−>aa−>4b exotic decays with ATLAS and CEPC . . . 139

Observation of γγ⟶ττ in ultraperipheral lead-lead collisions and constraints on ☒ g-2 with the ATLAS detector . . . 139

Recent progress in muon electric and magnetic dipole moments . . . 140

Software development and performance studies of New Small Wheel in ATLAS for LHC Run3 . . . 140

A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery . . . 140

Search for Dark Higgs at ATLAS and potential to utilize the Xbb tagger . . . 140

Dark matter searches with jets at ATLAS . . . 140

Measurement and Reinterpretation of four-top-quark production cross section with the ATLAS detector in pp collisions at √ s = 13 TeV 141

Study of the CP property of the Higgs to vector-boson coupling in the VBF □->□□ channel with the ATLAS detector 141

Search for Higgs boson pair production in □□□□ final state in □□ collisions at √□ = 13 TeV with the ATLAS detector 141

Observation of γγ⟶ττ in ultraperipheral lead-lead collisions and constraints on □ g-2 with the ATLAS detector 141

Constraining the Higgs boson self-coupling from single- and double-Higgs production with the ATLAS detector using pp collisions at sqrt(s)=13 TeV 141

Measurement of Zgamma plus jets differential cross section using 139 fb-1 data collected by the ATLAS detector 142

Search for the direct production of charginos and neutralinos in final states with tau leptons in 13 TeV pp collisions with the ATLAS detector 142

A search for heavy Higgs bosons decaying into vector bosons in same-sign two-lepton final states in pp collisions at Ös=13 TeV with the ATLAS detector 142

Cross terms in the fit function for the precession frequency analysis in the Fermilab Muon g-2 experiment 142

A Boosted Decision Tree Model for the positron acceptance in the Muon g-2 experiment 142

Muon beam based on GeV electron on target 143

Muon and pion production from electron on target 143

Measurement of Muon Lifetime with Muon g-2 Experiment at Fermilab 143

Pileup Background Study with Muon g-2 Experiment at Fermilab 143

An improved pulse-fitting procedure for calorimeter event reconstruction in the Muon g-2 experiment at Fermilab 143

A search for the muon electric dipole moment in the Fermilab Muon g-2 experiment . . 143

Spacer configuration optimization for RPCs based on COMSOL Multiphysics simulation 144

Dark SHINE——Dark Photon fixed-target search experiment at SHINE Facility 144

Sterile neutrino studies using Daya Bay, MINOS, and Bugey-3 data 144

高能物理分会第十一届委员会主任致辞 144

“晨光杯”颁奖 144

闭幕式 144

宣布高能物理分会换届结果 145

第十一届高能物理分会主任致辞 145

“晨光杯”颁奖 145
Measurement of mass and width of the Higgs boson at HL-LHC 145
Lastest nH oscillation results from Daya Bay 145
致谢，闭幕式 145

Parallel Session II (2)：Hadron and Flavor Physics / 0

Triangle Singularity in the Production of Tcc(3875) and a Soft Pion

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The double-charm tetraquark meson T_{cc}^{+} (3875) can be produced in high-energy proton-proton collisions by the creation of the charm mesons $D^{*+}D^{0}$ at short distances followed by their binding into T_{cc}^{+} . The T_{cc}^{+} can also be produced by the creation of $D^{*+}D^{*+}$ at short distances followed by their rescattering into T_{cc}^{+} $^{+}$. A charm-meson triangle singularity produces a narrow peak in the T_{cc}^{+} $^{+}$ invariant mass distribution 6.1 MeV above the threshold with a width of about 1 MeV. Well beyond the peak, the differential cross section decreases with the invariant kinetic energy E of T_{cc}^{+} $^{+}$ as $E^{-1/2}$. The fraction of T_{cc}ˆ+ that are accompanied by $^{+}$ with $E < m$ is estimated to be roughly 3%. The fraction of T_{cc}^{+} events with T_{cc}^{+} $^{+}$ in the narrow peak from the triangle singularity could be comparable.

2

Time evolution of global polarization within an improved microscopic approach

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Extremely large angular orbital momentum can be produced in non-central heavy-ion collisions, leading to a strong transverse polarization of partons that scatter through the quark-gluon plasma (QGP) due to spin-orbital coupling. To understand the hyperon polarization observed in relativistic nuclear collisions, we develop a microscopic approach to describe the formation and space-time evolution of quark polarization inside the QGP. Production of polarization both from the initial hard scatterings and during the QGP expansion have been consistently described using the quark-potential scattering approach, which has been coupled to realistic initial condition calculation and the subsequent (3+1)-dimensional viscous hydrodynamic simulation of the QGP for the first time. Within this improved approach, we have found that different rapidity-dependent initial energy density distributions generate different time evolution profiles of the longitudinal flow velocity gradient of the QGP, which further lead to an approximately 15% difference in the final polarization of quarks collected on the hadronization hypersurface of the QGP. Therefore, in addition to the collective flow coefficients, the hyperon polarization could serve as a novel tool to help constrain the initial condition of the hot nuclear matter created in high-energy nuclear collisions.

Parallel Session V (1)：TeV and BSM Physics / 4

General Heavy WIMP Direct Detection

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Weakly-Interacting-Massive-Particles (WIMPs) are a large class of viable dark matter candidates. We employ heavy particle effective field theory to compute general heavy electroweak multiplets and nucleon elastic scattering up to heavy mass $1/M$ order.

For certain electroweak multiplets, leading order effective theory calculation shows a generic amplitude-level cancellation that yields a severe suppression of the cross section for WIMP-nucleon scattering, leaving them robust candidates surviving current direct detection experimental sensitivities.

We here perform computation for arbitrary electroweak representations for
all spin-0, spin-1/2, spin-1 and spin-3/2 heavy particles, combining contributions from perturbative QCD and nuclear effects
by state-of-the-art chiral effective theory calculations, and obtain a comprehensive and model-independent WIMP-nucleon benchmark cross section and
WIMP-nucleus direct detection event rate.

Parallel Session II (3)：Heavy Ion Physics / 7

Probing initial longitudinal geometry and electromagnetic field with directed flows of soft and heavy flavor hadrons

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Relativistic heavy-ion collisions provide a unique opportunity to investigate properties of nuclear matter under extremely strong electromagnetic field. Using a heavy quark transport model that includes both collisional and radiative energy loss of heavy quarks, coupled to a (3+1)-dimensional viscous hydrodynamic model CLVisc, we study the initial longitudinal energy density distribution and the time evolution of electromagnetic field via both soft and heavy flavor hadron observables. With a systematic comparison between three different initial energy density profiles –Bożėk-Wyskiel, CCNU (Phys.Rev.C 104 (2021) 6, 064903) and Shen-Alzhrani, we find a counter-clockwise tilt of the initial geometry in the reaction plane is crucial for understanding the rapidity dependence of directed flow (v1) of both soft hadrons and D mesons at RHIC and LHC (Phys.Rev.C 105 (2022) 3, 034901). Meanwhile, the difference of v1 between D and Dbar is shown to be sensitive to the time evolution behavior of the electromagnetic field that generates opposite forces on c and cbar. This time evolution behavior is shown to be further constrained by the elliptic flow (v2) of soft hadrons due to the force density (squeezing effect) induced by the magnetic field inside the paramagnetic QGP medium. Therefore, a simultaneous description of soft and heavy flavor hadron v1 and v2 is required for a stringent constraint on the properties of electromagnetic field produced in high-energy nuclear collisions. Additional observables, such as the v1 (and Δv_1) of heavy flavor decayed leptons are predicted, which can be tested by experimental measurements in the near future(submit to PRC).

Parallel Session V (1)：TeV and BSM Physics / 9

右手中微子的对撞机寻找与轻子生成机制

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中微子质量问题是粒子物理标准模型现有的重大问题之一。利用含有右手中微子的跷跷板机制可以解释该问题，同时右手中微子又可以通过轻子生成机制解释宇宙正反物质不对称，因此寻找右手中微子是一个极具吸引力的课题。然而，对撞机实验在框架下无法直接寻找到右手中微子检验跷跷板机制。我们基于模型，研究了该模型额外的右手中微子产生通道。利用其独特的长寿命粒子信号，我们进行了对撞机唯象学分析，发现在一定参数空间内，可以成功检验跷跷板机制。与此同时，额外的右手中微子产生通道在轻子生成机制中，能够产生强烈的冲刷项，大大减少产生的正反物质不对称。所以对撞机寻找该通道也能够检验轻子生成机制。

Parallel Session II (1)：TeV and BSM Physics / 11

An possible explanation for three generations of leptons and quarks and the asymmetry of number of baryons and antibaryons based on the SU(5) grand unified model with hadrons as nontopological solitons

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The three generations of leptons and quarkons have been discovered. The left-right asymmetry in the weak interaction of leptons and quarks has been confirmed. Astronomical observations have showed that the number of baryons and antibaryons is asymmetrical in the observabale cosmos. This paper shows that there is the same origin of the left-right asymmetry and the asymmetry of number of baryons and antibaryons. The three generations of leptons and quarkons and the two sorts of asymmetry are explained in this paper based on the SU(5) grand unified model with hadrons as nontopological solitons.

Summary:

Parallel Session II (1)：TeV and BSM Physics / 12

Probing the Zbb anomalous couplings

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To resolve the long-standing discrepancy between the precision measurement of bottom quark forward-backward asymmetry at LEP/SLC and the Standard Model prediction,

we propose four different novel methods to probe the Zbb couplings by measuring $gg \to Zh$ production, Z boson exclusive decay at the LHC and (average jet charge weighted) single-spin asymmetry at the HERA and EIC. We demonstrate that $gg \to Zh$ cross section, the branching ratio of $Z \to \Upsilon(ns) + \gamma$,
and jet charge weighted single-spin asymmetry are sensitive to the axial-vector component of the Zbb coupling, while the single-spin asymmetry is sensitive to the vector component. The apparent degeneracy of the Zbb couplings implied by the LEP precision electroweak measurements could be resolved by the current 13 TeV LHC Zh data.
We also show the potential to verify or exclude the LEP data and resolve the AFB puzzle through those methods.

Parallel Session V (1)：TeV and BSM Physics / 13

Neutrino dipole portal at electron colliders

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We propose to search for a heavy neutral lepton (HNL), that is also known as sterile neutrino, in electron colliders running with the center-of-mass energies at few GeV, including BESIII, Belle II, and the proposed Super Tau Charm Factory (STCF). We consider the HNL interacting with Standard Model neutrino and photon via a transition magnetic moment, the so-called dipole portal. We use the monophoton signature at electron colliders to probe the constraints on the active-sterile neutrino transition magnetic moments d as the function of the HNL's mass m_N. It is found that BESIII, Belle II and STCF can probe the upper limits for d down to 1.3×10^{-5} GeV^{-1}, 8×10^{-6} GeV^{-1}, and 1.3×10^{-6} GeV^{-1} with m_N around GeV scale, respectively, and have sensitivity to the previously unexplored parameter space for electron- (d_e) and tau-neutrino (d_τ) dipole portal with m_N from dozens to thousands MeV. On d_μ for HNL mixing with the μ-neutrino, Belle II and STCF can also provide leading constraints.

Parallel Session I (1)：TeV and BSM Physics / 14

Resummation of large logarithms in cross sections at subleading power

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散射截面是研究粒子基本结构和相互作用的基本观测量。当散射过程涉及多个能标时，精确计算结果很难得到。当能标之比很大时，结果会展示出大对数结构。在领头幂次阶，该大对数已经了解的比较清楚了。但是在次领头幂次阶，会出现新的困难，例如端点发散。这时需要发展新的理论来处理这些困难。我将介绍这方面的最新进展。

Parallel Session VI (3)：Heavy Ion Physics / 16

Lepton pair photoproduction in peripheral relativistic heavy-ion collisions

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We study the lepton pair photoproduction in peripheral heavy-ion collisions based on the formalism in our previous work. We present the numerical results for the distributions of the transverse momentum, azimuthal angle and invariant mass for e+e− and μ+μ− pairs as functions of the impact parameter and other kinematic variables in Au+Au collisions. Our calculation incorporates the information on the transverse momentum and polarization of photons which is essential to describe the experimental data. We observe a broadening effect in the transverse momentum for lepton pairs with and without smear effects. We also observe a significant enhancement in the distribution of cos(2ϕ) for μ+μ− pairs. Our results provide a baseline for future studies of other higher order corrections beyond Born approximation and medium effects in the lepton pair production.

Parallel Session I (3)：Heavy Ion Physics / 19

Parton splitting scales of reclustered large-radius jets in high-energy nuclear collisions

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We carry out the first theoretical investigation on
yields and the hardest parton splitting of large-radius jets
reclustered from small radius (R = 0.2) anti-kt jets in Pb +
Pb collisions, and confront them with the recent ATLAS measurements. The Linear Boltzmann Transport (LBT) model is
employed for jet propagation and jet-induced medium excitation in the hot-dense medium. We demonstrate that, with their
complex structures, the medium suppression of the reclustered large radius jets at R = 1 is larger than that of inclusive
R = 0.4 jets defined conventionally. The large radius jet
constituents are reclustered with the kt algorithm to obtain
the splitting scale √d12, which characterizes the transverse
momentum scale for the hardest splitting in the jet. The large radius jet production as a function of the splitting scale √d12
of the hardest parton splitting is overall suppressed in Pb + Pb
relative to p + p collisions due to the reduction of jets yields.
A detailed analyses show that the alterations of jet substructures in Pb + Pb also make significant contribution to the
splitting scale √d12 dependence of the nuclear modification
factor RAA. Numerical results for the medium modifications
of the jet splitting angle R12 and the splitting fraction z are
also presented

Summary:

We have carried out the first detailed theoretical investigation of the medium modification on the reclustered LR jets production as well as its the hardest parton splitting in Pb + Pb collisions relative to that in p + p collisions. The nuclear
modification factor of the reclustered LR jets evaluated as a function of jet transverse momentum is a little smaller than the value of inclusive R = 0.4 jets. A quantitative calculation of the absolute amount of the transverse momentum missing in the medium shows that reclustered LR jets will lose larger fraction of its energy than inclusive R = 0.4 jets with the same transverse momentum due to its complex structure. The fraction of energy loss via jet quenching rapidly increases in the region pˆjet_T < 80 GeV/c, and smoothly decreases with increasing pˆjet_T when p jet T > 80 GeV/c. As a result of which, the nuclear modification factor for reclustered LR jet is a little smaller than that of inclusive R = 0.4 jet and increases smoothly with increasing pˆjet_T.

The jet spectrum evaluated as a function of the splitting
scale √d12 of the hardest parton splitting obtained from a
reclusting procedure is overall suppressed in Pb + Pb collisions relative to p + p collisions and the nuclear modification
factor RAA sharply decreases with increasing √d12 for small
values of the splitting scale followed by flattening for larger
√d12. The suppression is a result of the reduction of jet yields
as well as the modification on the jet fragmentation pattern.
Jet energy loss dominates the modification in large splitting
scale region, while the change of jet fragmentation pattern via
different modification mechanism has almost 50% contributions in small splitting scales region. √d12 is strongly correlated to the splitting angle R12 and fragmentation function z. A detailed calculation of the splitting angle R12 and fragmentation function z shows that reclustered LR jet with small
splitting angle or small z is less suppressed, which lead to the
√d12 dependence of the nuclear modification pattern.

A further investigation on splitting angle R12 from (≥
2) ⟶ (≥ 2) processes shows that jet yield is suppressed
in small R12 < 0.25 region, while is enhanced in 0.25 <
R12 < 0.5 region, and keeps unmodified in large R12
region. Further, we find that (≥ 2) ⟶ 1 processes plays
a dominant role in the reduction of jet yields in large R12
region. And the contribution of 1 ⟶ (≥ 2) processes is much
larger than that from (≥ 2) ⟶ 1 processes in small angle
region, which gives the enhancement of jet yield in small
R12 region.

Finally, we demonstrate that in (≥ 2) ⟶ (≥ 2) processes
the z distribution in Pb + Pb is moderately enhanced in small z region and suppressed in large z region. In addition, contribution from 1 ⟶ (≥ 2) processes is larger than that from
(≥ 2) ⟶ 1 processes in the whole region, which may moderately increase the jet yields. The total contributions of these
three processes give rise to a large deviation in small z region
and moderate difference in large z region in Pb + Pb collisions as compared to p + p collisions, and eventually leading
to the √d12 dependence of the nuclear modification factors.

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 20

Prediction of \psi_0 (4360) as a moleclue of Dˆ* \bar D_1 with Jˆ{PC}=0ˆ{−}

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Exotic hadrons have attracted lots of interests in recent years and there are many experimental candidates of such states. We focus on the bound state of $D^*\bar{D}_1$ with the exotic quantum numbers $J^{PC} = 0^{--}$, named as $\psi_0(4360)$. We predict the existence of the $\psi_0(4360)$ and its binding energy with parameters determined by assuming the $\psi(4230)$,$\psi(4360)$ and $\psi(4415)$ states be the $D\bar{D}_1$, $D^*\bar{D}_1$ and $D^*\bar{D}_2$ molecules, respectively. We mainly focus on the t channel vector- and pseudoscalar-meson exchange, including couped-channel effects. We also discuss the u channel pion exchange, which contributes to the long range interaction. In this case the pion can go on-shell, the $D^*\bar{D}^*\pi$ three body effects have been properly treated. It turns out that the t channel potential is enough to form a bound state, $\psi_0(4360)$, and the u channel effect does not change the qualitative conclusion. Since the $\psi(4360)$ is located in the same mass range, we discuss how to distinguish these two particles by an anglar distribution analysis.

Summary:

Parallel Session I (3)：Heavy Ion Physics / 22

p_T dispersion of inclusive jets in high-energy nuclear collisions

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In this work, we study the impact of jet quenching on p_T dispersion($p_T D$) of inclusive jets ($R = 0.2$) in Pb+Pb collisions at $\sqrt{s} = 2.76$˜TeV.
The partonic spectrum in the initial hard scattering of elementary collisions are obtained by an event generator POWHEG+PYTHIA, which matches the next-to-leading (NLO) matrix elements with parton showering, and energy loss of fast parton traversing in hot/dense QCD medium is calculated by Monte Carlo simulation within Higher-Twist formalism of jet quenching in heavy-ion collisions.
We present the model calculations of normalized $p_T D$ distributions for inclusive jets in p+p and Pb+Pb collisions at $\sqrt{s} = 2.76$˜TeV, which give nice descriptions of ALICE measurements. It is shown that the $p_T D$ distributions of inclusive jets in Pb+Pb significantly shifts to higher $p_T D$ region relative to that in p+p. Thus the nuclear modification ratio of $p_T D$ distributions for inclusive jets is smaller than unity at small $p_T D$ region, while larger than one at large $p_T D$ region. This behavior results from more uneven p_T distribution of jet constituents as well as the fraction alteration of quark/gluon initiated jets in heavy-ion collisions. The difference of $p_T D$ distributions between groomed and ungroomed jets in Pb+Pb collisions are also discussed.

Parallel Session IX (1)：TeV and BSM Physics / 23

N = 4 supersymmetric Yang-Mills thermodynamics to order λˆ2

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We calculate the resummed perturbative free energy of N = 4 supersymmetric Yang-Mills in four spacetime dimensions $SYM_{4,4}$ through second order in the ’ t Hooft coupling λ at finite temperature and zero chemical potential. Our final result is ultraviolet finite and all infrared divergences generated at three-loop level are canceled by summing over $SYM_{4,4}$ ring diagrams. Non-analytic terms at $\mathcal{O}(^{3/2})$ and $\mathcal{O}(^{2}log)$ are generated by dressing the A_0 and scalar propagators. The gauge-field Debye mass m_D and the scalar thermal mass M_D are determined from their corresponding finite-temperature self-energies. Based on this, we obtain the three-loop thermodynamic functions of $SYM_{4,4}$ to $\mathcal{O}(^{2})$.

Summary:

By comparing our final result with prior results obtained in the weak- and strong-coupling limits and construct a generalized Padé approximant that interpolates between the weak-coupling result and the large-N_c strong-coupling result. Our results suggest that the $\mathcal{O}(^{2})$ weak-coupling result for the scaled entropy density is a quantitatively reliable approximation to the scaled entropy density for 0 ≤ λ ⊠ 2.

Parallel Session IX (5)：Particle Detector Technology / 24

PandaX-4T 暗物质探测器超高纯氙气回收系统

作者： Li Zhao[1]; Tao Zhang[1]; Wenbo Ma[1]; Zhou Wang[1]

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为了 PandaX-4T 暗物质探测器在紧急情况或者停止运行时，在保证探测器中的低温低压环境且不污染超高纯氙的前提下，高流量地将探测器中的氙回收到高压气瓶中，设计研制了超高纯氙气回收系统。该回收系统主要包含加热系统、工作管路、回流管路、辅助回收管路和自动控制系统。该系统可以保证在 PandaX-4T 暗物质探测器内 2~3 个大气压和 178~186.5K 的情况下，通过加热系统汽化探测器中的液氙，并采用隔膜式压缩机将探测器内的氙气无泄漏地以 200SLPM 的速率压缩至 6MPa，充入 128 瓶 40L 的标准气瓶中。期间保证氙气的纯度，使其不受污染。这对温度压力环境要求严苛、低本底的大型暗物质探测器的运行至关重要。

Parallel Session VIII (3)：Heavy Ion Physics / 27

The theoretical calculation of exclusive vector meson production at future EIC and EicC

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Coherent vector meson photoproduction plays important role for investigating the partionic composition of protons and nuclear targets. Especially,
it provides a novel tool to prob the gluonic structure of nuclei. In this talk,
we present a theoretical framework to calculate the photoproduction cross section of vector mesons. In this framework, we derive an equivalent approximate
photon distribution in coordinate space based on QED, which overcomes the weakness of traditional EPA at large virtuality of photon. The vector meson dominance model together with quantum Glauber approach are employed in the calculation. We will show the calculated rapidity and pt distribution of Jpsi photoprouction for both ep and eAu collisions at the planned energy sets at future EIC and EicC, which could served as event generator for detector design and physics opportunity projection.

Parallel Session I (5)：Particle Detector Technology / 28

Dark SHINE——Dark Photon fixed-target search experiment at SHINE Facility

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合作者： Haijun Yang [2]; Jun Guo [3]; Kim Siang Khaw [4]; Kun LIU [4]; Liang Li [3]; Shu Li [4]; Weihao Wu [3]

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This talk will present the RD; study of the prospect and feasibility to deploy the fixed-target experiment utilizing the high rate single electron beam from the SHINE facility under construction. The project is officially sponsored by NSFC Original Exploration Project 2021 and Shanghai pilot program for basic research.

Summary:

Parallel Session X(1)：TeV and BSM Physics / 29

Search for Dark Higgs at ATLAS and potential to utilize the Xbb tagger

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This talk will present the latest searches for Mono-H125 and Mono-Scalar productions with SM and BSM Higgs as a direct probe to BSM portal of new physics and especially Dark Matter. A potential of utilizing the boosted Xbb tagger will be also discussed.

Parallel Session VIII (1)：TeV and BSM Physics / 30

Search for HH−>4b proudction and H−>aa−>4b exotic decays with ATLAS and CEPC

作者： Xuliang Zhu[1]; Zhen Wang[1]

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This talk will present the HH−>4b analysis result at ATLAS and also the exotic decays of 125GeV SM Higgs to light scalar pairs in 4b final states with future circular colliders such as CEPC.

Parallel Session VI (1)：TeV and BSM Physics / 31

Vector Boson Scattering and new phenomena at LHC

作者： Despoina Sampsonidou[1]; Haijun Yang[2]; Jing Chen[2]; Shu Li[1]

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Observations of Vector Boson Scattering processes (VBS) are one of the major achievements of EWSB and Higgs unitarization mechanism studies at LHC Run2. This talk will bring the latest news from LHC in VBS observations and highly evident measurements, as well as the bridge to new physics portal utilizing such scattering final states.

Parallel Session X(1)：TeV and BSM Physics / 32

Precise Measurements of Z+photon final states and search for anomalous neutral gauge couplings with EFT at ATLAS

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This talk will present the latest result of precise measurement of Z+photon+jets differential cross sections and the probe of BSM new physics via anomalous neutral gauge couplings parameterized with EFT formalism at ATLAS.

Parallel Session I (3)：Heavy Ion Physics / 33

Jet-like correlations with V^0 triggered particles in p-p and pb-pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV

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Two-particle correlations with V^0 ($K^0_S, \Lambda/\bar{\Lambda}$) and charged hadrons as trigger particles of transverse momentum
$8 < p_{\mathrm{T,trig}} < 16$ GeV/c, and associated charged particles of $1 < p_{\mathrm{T,assoc}} < 8$ GeV/c, are studied at mid-rapidity in pp and most central Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV with the ALICE detector at the LHC.
After contributions of the flow background is subtracted, the per-trigger yields are extracted, and the nuclear modification factor, I_{AA}, is calculated on both near and away side.
The results of I_{AA} show strongly suppression on away-side and enhancement at low p_{T} on both near- and away-side consistence with previous ALICE measurement of neutral pion (π^0-h) and charged hadrons (h-h) in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 2.76 TeV. In addition, the data are described within uncertainties by AMPT and HIJING event generators.

Summary:

Parallel Session I (3)：Heavy Ion Physics / 34

Forward Single Inclusive Jet Production in pA Collisions at Next-to-leading Order with Threshold Resummation

作者： Hao-yu Liu[1]; Ke-xin Xie[1]; Xiaohui Liu[1]; Zhongbo Kang[2]

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My talk is baesed on our work of presenting the first complete next-to-leading-order (NLO) prediction for the single inclusive jet production in pA collisions at forward rapidities within the color glass condensate (CGC) effective theory. Our prediction is fully differential over the final state physical kinematics, which allows the implementation of the full jet clustering algorithm in our calculation, as well as any other infra-red safe observables. The NLO calculation is setup with the aid of the observable originated power counting framework we proposed which gives rise to the novel soft contributions in the CGC factorization. We achieve the fully-differential calculation by constructing suitable subtraction terms to handle the singularities in the real corrections. The subtraction contributions can be exactly integrated analytically. The NLO calculation demonstrates explicitly the validity of the CGC factorization theorem to the jet production. Furthermore, as a byproduct of the subtraction method, we also derive the fully analytic cross section for the forward jet production in the small-R limit. We show that in the small-R limit, the forward jet cross section can be factorized to a semi-hard cross section that produces a parton and the semi-inclusive jet function (siJF),just like the jet production in the central region where exactly the same siJF shows up. We argue this feature holds for generic jet productions in the CGC framework. Last, we show numerical predictions of the jet transverse momentum and energy distributions. Like the forward hadron production, the obtained NLO result also exhibits the negative cross section in the large jet transverse regime, this talk also contains our solution to this which is the threshold resummation.

Parallel Session IV (3)：Heavy Ion Physics / 36

Overview of intermittency analysis in heavy-ion collisions

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Local density fluctuation near the QCD critical point has been suggested to exhibit a power-law behavior which can be probed by an intermittency analysis on scaled factorial moment in relativistic heavy-ion collisions.

In this talk, I will review recent work on the search for power-law fluctuations with fractality and intermittency analysis in heavy-ion collisions. Experimental measurement from STAR, NA49 and NA61 collaborations[1-3] on self-similar correlations and fluctuations with respect to the size of phase space volume in various high energy collisions are presented, with special emphasis on background subtraction and efficiency correction of the measurement. Phenomenological modelling and theoretical work on the subject are discussed[4-7]. Finally, I will highlight possible directions for future research[8].

1T. Anticic et al. (NA49 Coll.), Eur. Phys. J. C 75, 587 (2015).

2M. Pawlowska et al. (NA61/SHINE Coll.), Nucl. Phys. A 1005, 121753 (2021).

3Jin Wu (for the STAR Coll.), arXiv: 2110.09794 (2021).

[4]Jin Wu, Yufu Lin, Yuanfang Wu, Zhiming Li*, Phys. Lett. B 801, 135186 (2020).

[5]Jin Wu, Yufu Lin, Zhiming Li* Xiaofeng Luo*, and Yuanfang Wu*, Phys. Rev. C 104, 034902 (2021).

[6]P. Li et al., Phys. Lett. B 818, 136393 (2021).

[7]S. Gope and B. Bhattacharjee, Eur. Phys. J. A 57, 44 (2021).

[8]Zhiming Li*, arXiv: 2203.01490 (2022).

Parallel Session VII (3)：Heavy Ion Physics / 37

X(3872) Production in Relativistic Heavy-Ion Collisions

作者： Baoyi Chen[1]

合作者： Jiaxing ZHAO [2]; Xiao-Hai Liu [1]; liu jiang [3]; yunpeng liu [4]

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Heavy ion collisions provide a unique opportunity to study the nature of X(3872)
compared with electron-positron and proton-proton (antiproton) collisions.
We investigate the centrality and momentum dependence of X(3872)
in heavy-ion collisions
via the Langevin equation and instant coalescence model (LICM).
When X(3872) is treated as a compact tetraquark state, the tetraquarks are
produced via the
coalescence of heavy and light quarks near the quantum chromodynamic (QCD) phase transition due to the
restoration of the heavy quark potential at $T \to T_c$. In the molecular scenario,
loosely bound X(3872) is produced via the coalescence of

D^0-$\bar{D}^{*0}$ mesons in a hadronic medium after kinetic freeze-out.
We employ the LICM to explain both D^0 and J/ψ production as a
benchmark. Then we give predictions regarding X(3872) production and the nuclear modification factor $R_{AA}^{X(3872)}$.
We find that the total yield of tetraquark is several times larger than the
molecular production in Pb-Pb collisions.
Although the geometric size of the hadronic molecule is huge,
the coalescence probability is small due to strict constraints on the
relative momentum between
D^0 and $\bar{D}^{*0}$ in the molecular Wigner function,
which significantly suppresses the molecular yield.

Parallel Session X(1)：TeV and BSM Physics / **39**

Search for top quark FCNC interactions at ATLAS

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The large dataset collected by the ATLAS detector at allows to probe the presence of new physics that could enhance the rate of rare processes in the SM. The LHC can therefore gain considerable sensitivity for Flavour Changing Neutral Current (FCNC) interactions of the top quark. The ATLAS experiment has performed searches for FCNC couplings of the top quark with a photon, gluon, Z boson or Higgs boson. In this report, the most recent results are presented, which include the complete data set of 139/fb at 13 TeV during run 2 (2015-2018). The large data set, together with improvements in the analysis, yields a strong improvement of the expected sensitivity compared to previous experiments.

Parallel Session X (2)：Hadron and Flavor Physics - Posters / **43**

Constraining gluon polarization in the proton

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We perform the first simultaneous global QCD analysis of spin-averaged and spin-dependent parton distribution functions (PDFs), including single jet production data from unpolarized and polarized hadron collisions. We critically assess the impact of SU(3) flavor symmetry and PDF positivity assumptions on the quark and gluon helicity PDFs, and find strong bias from these, particularly on the gluon polarization. The simultaneous analysis allows for the first time extraction of individual helicity-aligned and antialigned PDFs with a consistent treatment of uncertainties.

Summary:

Parallel Session I (3)：Heavy Ion Physics / **44**

Unraveling Gluon Jet Quenching through J/ψ Production in Heavy-Ion Collisions

作者： Shan-liang Zhang[1]

合作者： Enke Wang [2]; Guang-You Qin [3]; Hongxi Xing [2]; JINFENG LIAO [4]

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[2] *South China Normal University*

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[4] *INDIANA UNIVERSITY & RBRC*

Jet quenching has long been regarded as one of the most important signatures for the discovery of Quark-Gluon Plasma created in heavy-ion collisions. Despite significant efforts, separate identification of quark and gluon jet quenching has remained as a challenge. We illustrate for the first time that energetic J/ψ production can be served as a unique probe to the gluon jet quenching mechanism. Within the framework of leading power NRQCD factorization formalism for the baseline of proton-proton collisions, we identify that gluon fragmentation dominates the production of J/ψ in high transverse momentum region. We then implement the linear Boltzmann transport model for the simulation of medium modification, the obtained results of nuclear modification factor R_{AA} and elliptic flow v_2 agree with the experimental data, which demonstrates the significance of gluon jet quenching in J/ψ production in nucleus-nucleus collisions. We further verify such effect by performing a fully data-driven analysis of the experimental data with Bayesian technique, which allows us to extract quantitatively the gluon jet quenching in high energy heavy-ion collisions.

Parallel Session III (3): Heavy Ion Physics / **45**

Hard-soft tomography with event engineering in heavy-ion collisions

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The azimuthal anisotropy of parton energy loss in non-central heavy-ion collisions can lead to jet anisotropy, which can provide insight into the path-length dependence of jet quenching. Jet anisotropy flow in this study is investigated within the Linear Boltzmann Transport model, in which the dynamical evolution of the QGP is simulated with fully fluctuating event-by-event initial conditions. We quantify the colliding energy, centrality, jet transverse momentum dependence of the jet anisotropy flow coefficient $v_2^{\rm jet}$ and $v_3^{\rm jet}$, with emphasis on their event-by-event correlations with the flow coefficients of the soft bulk hadrons. We find that the correlation between jet and bulk anisotropy is approximately linear, and that the effect of the bulk v_n fluctuation on the event-averaged jet $v_n^{\rm jet}$ is negligible. Other effects such as medium excitation with different jet cone sizes and viscosity of the QGP on jet anisotropy are investigated as well.

Parallel Session VII (2)：Hadron and Flavor Physics / **46**

The production of doubly charmed exotic hadrons in heavy ion collisions

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Hadron spectroscopy provides direct physical measurements that shed light on the non-perturbative behavior of quantum chromodynamics (QCD). In particular, various exotic hadrons such as the newly observed T_{cc}^+ by the LHCb collaboration, offer unique insights into the QCD dynamics in hadron structures. In this letter, we demonstrate how heavy ion collisions can serve as a powerful venue for hadron spectroscopy study of doubly charmed exotic hadrons by virtue of the extremely charm-rich environment created in such collisions. The yields of T_{cc}^+, as well as its potential isospin partners, are computed within the molecular picture for Pb-Pb collisions at center-of-mass energy $2.76\ \mathrm{TeV}$. We find about three-order-of-magnitude enhancement in the production of T_{cc}^+ in Pb-Pb collisions as compared with the yield in proton-proton collisions, with a moderately smaller enhancement in the yields of the isospin partners T_{cc}^0 and T_{cc}^{++}. The T_{cc}^+ yield is comparable to that of the $X(3872)$ in the most central collisions while showing a considerably stronger decrease toward peripheral collisions, due to a "threshold" effect of the required double charm quarks for T_{cc}^+. Final results for their rapidity and transverse momentum p_T dependence as well as the elliptic flow coefficient are reported and can be tested by future experimental measurements.

Parallel Session IX (1)：TeV and BSM Physics / 47

Axion Quality from Superconformal Dynamics

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We discuss a possibility that a superconformal dynamics induces the emergence of a global U(1)PQ symmetry to solve the strong CP problem through the axion. Fields spontaneously breaking the U(1)PQ symmetry couple to new quarks charged under the ordinary color SU(3)C and a new SU(N) gauge group. The theory flows into an IR fixed point where the U(1)PQ breaking fields hold a large anomalous dimension leading to the suppression of U(1)PQ -violating higher dimensional operators. The spontaneous breaking of the U(1)PQ makes the new quarks massive. The U(1)PQ symmetry is anomalous under the SU(3)C but not under the SU(N) so that the axion couples to only the color SU(3)C and the usual axion potential is generated. We also comment on a model that the U(1)PQ breaking fields are realized as meson superfields in a new supersymmetric QCD.

Parallel Session II (3)：Heavy Ion Physics / 48

Probing the nuclear deformation with three-particle asymmetric cumulant in isobar collisions at RHIC

作者： Hao-jie Xu[1]; Huichao Song[2]; Shujun Zhao[2]; Yu-Xin Liu[2]

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Isobar collisions at RHIC provide unique opportunities to study the geometry and fluctuations raised from the deformation of the colliding nuclei. Using iEBE-VISHNU hybrid model, we predict $ac_2\{3\}$ ratios between these two collision systems and demonstrate that the ratios of $ac_2\{3\}$, as well as the

ratios of the involving flow harmonics and event-plane correlations, are sensitive to quadrupole and octupole deformations, which provides strong constrain on the shape differences between Ru and Zr.

Parallel Session V (3)：Heavy Ion Physics / 49

Searching QCD critical point with light-nuclei productions

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Searching QCD critical point is one of the fundamental goals of heavy-ion collisions. The observed non-monotonic behavior with the colliding energies[1,2] was declared to be related to the critical point of the QCD phase diagram[3,4].

To reveal the critical fluctuations effects on the light-nuclei productions, one should address the problem of scale separation and magnitude separation problems. Specifically, the scale or the magnitude related to the background effects on light-nuclei production are dramatically larger than the ones of critical fluctuations, which hinders the detection of critical signal in light-nuclei individually. In this talk, I will focus on this problem and study the possible effect.

Within the coalescence model, we systematically study how does the background[5] and critical signal[6] play the role in the production of light nuclei. We find that the productions of light-nuclei with different number of constituent nucleons share the same structure up to second-order phase-space cumulants.
Accordingly, we construct light-nuclei yield ratio which is directly proportional to the critical correction. The large scales related to light-nuclei are largely cancelled in the ratios and critical correlation length plays an important role. This reveals that the properly constructed yield ratios, not the yield individually, largely free from the scale and magnitude problems. In addition, we also predict a non-trivial behavior of the constructed light-nuclei yield ratios as the imprint the critical fluctuations and could be regarded as one of the candidates to probe the critical point.

1 H. Liu, D. Zhang, S. He, K.-j. Sun, N. Yu, and X. Luo, Phys. Lett. B 805, 135452 (2020).

2 D. Zhang (STAR), JPS Conf. Proc. 32, 010069 (2020).

3 E. Shuryak and J M.Torres-Rincon, Eur.Phys.J.A 56 (2020) 9,241.

[4] K.-j. Sun, F.Li and C.M.Ko, Phys.Lett.B 816 (2021) 136258.

[5] S.Wu, K.Murase, S.Tang and H.Song, arXiv:nucl-th/2205.14302.

[6] S.Wu, K.Murase, S.Zhao and H.Song, to appear.

Parallel Session IX (3)：Heavy Ion Physics / 50

Signatures of the spin Hall effect in hot and dense QCD matter

作者： Baochi Fu[1]; LongGang Pang[2]; Yi Yin[3]; 慧超宋 [1]

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The spin Hall effect (SHE) is a generation of spin polarization for moving spin carriers in materials under an external electric field and has been observed in semiconductors, metals, and insulators at or below room temperature. Recent theoretical analyses show that spin Hall current can be induced by the baryon chemical potential gradient which plays the role of the analogous electric field and which becomes sizable in the fireballs created in heavy-ion collisions at beam energy of O(10) GeV. In this talk, we focus on this important mechanism and predict the signature of the SHE using a (3+1) D viscous hydrodynamic model MUSIC with AMPT initial condition. We propose to use the second Fourier coefficients of the net spin polarization of Lambda hyperon as sensitive probes to search for the SHE. Those SHE observables show a qualitative difference in both the sign and beam energy dependence for the situations with and without the SHE. Future experimental observation of these distinct qualitative features would provide strong evidence for the existence of the SHE in the hot and dense QCD matter at trillions of degrees.

Parallel Session II (5)：Particle Detector Technology / 51

基于外延层硅传感器的辐照损伤机理研究

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硅探测器的抗辐照研究是高能物理实验中的一个很重要的课题。基于外延层的硅传感器将是未来高能物理探测器的一个重要候选技术，然而其辐照损伤机理并未像高阻硅衬底传感器那样已被深入研究。本研究将对基于外延层的肖特基管进行各项测试，提取出 IV、CV 特性曲线以及电荷收集效率等参数在辐照前与不同剂量辐照后的变化，以建立基于外延层硅传感器的辐照损伤模型，适用中子辐照通量最高可至10^{16} n_{eq}/cm^2。本报告将对此研究的阶段性结果进行介绍。

The study of radiation resistance of silicon sensor is an important subject in high energy physics experiments. Silicon sensor with epitaxial layer will be a candidate technology for particle detector for future experiments. However, the mechanism of its bulk radiation damage is not as well studied as the sensors with high resistivity silicon substrate. In this study, dedicated Schottky diodes fabricated on epitaxial wafers will be tested, and the important properties such as IV and CV characteristic curves and charge collection efficiencies before and after neutron irradiation will be extracted, so as to build the bulk radiation damage model suitable up to the 10^{16} n_{eq}/cm^2.

Parallel Session III (3): Heavy Ion Physics / 53

Deep learning jet modifications in heavy-ion collisions

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合作者： Daniel Pablos [2]; Konrad Tywoniuk [3]

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Jet interactions with the hot QCD medium created in heavy-ion collisions are conventionally assessed by measuring the modification of the distributions of jet observables with respect to a proton-proton baseline. However, the steeply falling production spectrum introduces a strong bias toward small energy losses that obfuscates a direct interpretation of the impact of medium effects in the measured jet ensemble.

To tackle this issue, we employ a convolutional neural network, trained on jet images from the hybrid strong/weak coupling model, in order to extract the "original" or "initial'" transverse momentum of a given jet. Relying on the time scale separation between highly-virtual vacuum like processes and medium induced ones, one can define this "initial" energy as the energy of a jet within a cone of R as determined by the early times vacuum-like evolution, before medium effects become relevant. Despite many sources of fluctuations, we achieve good performance. Furthermore, by making use of alternative setups of networks and inputs, we are able to discuss the interpretability of our results.

With a well-predicted energy loss ratio, we study a set of jet substructure observables to estimate their sensitivity to selection bias effects and reveal their medium modifications when compared to a more equivalent jet population, i.e. a set of jets with similar initial energy. We show how this new technique provides unique access to the initial configuration of jets over the transverse plane of the nuclear collision, both with respect to their production points and initial orientations. As a relevant example, we demonstrate the capability of our method to locate with precision the production point of a dijet pair in the nuclear overlap region, in what constitutes an important step forward towards the long term quest of using jets as tomographic probes of the quark-gluon plasma. Finally, we also discuss the classification task of quark- versus gluon-initiated jets in heavy ion collisions with deep learning.

1 Yi-Lun Du, Daniel Pablos, Konrad Tywoniuk, Deep learning jet modifications in heavy-ion collisions, arXiv:2012.07797 [hep-ph], JHEP. 2021, 206 (2021)

2 Yi-Lun Du, Daniel Pablos, Konrad Tywoniuk, Jet tomography in heavy ion collisions with deep learning, arXiv:2106.11271 [hep-ph], Phys. Rev. Lett. 128, 012301 (2022)

3 Yi-Lun Du, Daniel Pablos, Konrad Tywoniuk, Classification of quark and gluon jets in hot QCD medium with deep learning, arXiv: 2112.00681 [hep-ph],
PoS(PANIC2021)224

Parallel Session I (3)：Heavy Ion Physics / 56

Exposing the dead-cone effect of jet quenching in QCD medium

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When an energetic parton traverses the hot QCD medium, it may suffer multiple scattering and energy losses. The medium-induced gluon radiation for a massive quark will be suppressed relative to that of a light quark due to the dead-cone effect. The development of new declustering techniques of jet evolution makes a direct study of the dead-cone effect in the QCD medium possible for the first time. In this work, we compute the emission angle distribution of the charm-quark initiated splittings in D^0 meson tagged jet and that of the light parton initiated splittings in inclusive jets in p+p and Pb+Pb at $5.02\tilde{}$TeV by utilizing the declustering techniques of jet evolution. The heavy quark

propagation and indued energy loss in the QCD medium are simulated with the SHELL model based on the Langevin equation. When comparing the jet number normalized emission angle distributions of the charm-quark initiated splittings and that of the light parton initiated splittings by directly taking their ratios at the same energy intervals of the initial parton, one can find the charm-quark initiated splittings will be suppressed at smaller emission angle corresponding to the dead-cone effect. The dead-cone effect of the jet quenching can be directly observed. We further investigate the case of the emission angle distributions normalized to the number of splittings in jets and find that the dead-cone effect will broaden the emission angle of the splitting and reduce the possibility of such splitting occurring, leading to the massive parton losing less energy.

Parallel Session VIII (3)：Heavy Ion Physics / 57

Probing polarized fragmentation functions in unpolarized collisions

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We briefly report our recent progress on the study of the polarized fragmentation functions of Λ hyperon in unpolarized semi-inclusive deep-inelastic scatterings and electron-positron annihilations at not-so-high energies. In particular, we present a simple but practical method on how to measure the azimuthal-angle-dependent longitudinal polarization and the transverse polarization inside the production plane and bridge these observables to the corresponding structure functions and fragmentation functions at the leading twist. Our work diversifies the high energy reactions that can probe the polarized fragmentation functions.

References

(1) K.B. Chen, Z.T. Liang, Y.K. Song, S.Y. Wei. Phys.Rev.D105, 034027. (2022)

(2) K.B. Chen, Z.T. Liang, Y.L. Pan, Y.K. Song, S.Y. Wei. Phys.Lett.B816, 136217. (2021)

Parallel Session II (2)：Hadron and Flavor Physics / 58

The Zcs states and the mixture of hadronic molecule and diquark-anti-diquark components within effective field theory

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In this work, we construct the Lagrangian describing meson-diquark interaction, such that the diquark-anti-diquark component as well as the molecular component is introduced when studying the Z_{cs} states. In this way, the problem is solved that if only considering the $\bar{D}^{(*)}D_s^{(*)}$ components, the potentials are suppressed by OZI rule. Through solving the Bethe-Salpeter equation, we find that the $Z_{cs}(4000)^+$ can be explained as the mixture of $\bar{D}^{*0}D_s^+$ and $\bar{A}_{cs}S_{cu}$ components. Besides, for the $\bar{D}^{*0}D_s^{*+}/\bar{A}_{cs}A_{cu}$ system, the pole of $4208 \pm 13i$ MeV on the second Riemann sheet is predicted,

whose mass is close to that of $Z_{cs}(4220)^+$ while the width is much smaller than $Z_{cs}(4220)^+$. Due to the large error of the $Z_{cs}(4220)^+$'s width, further measurements are expected. In addition, several other poles of different spins are predicted.

Parallel Session IV (3)：Heavy Ion Physics / 59

“jet quenching at finite cheimical potentials and near the CEP ”

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Jet quenching parameter $\hat{q}$ is an essential parameter that characterizes the interaction strength between jet partons and the QGP. Based on the quark-meson model, we conduct a first calculation on $\hat{q}$ at finite chemical potential up to the one-loop order, and find that the momentum broadening of jets is enhanced not only at high temperature, but also at high chemical potential. We further investigate the behavior of $\hat{q}$ near the critical end point (CEP) of the QCD phase diagram by coupling our calculation with a recently developed equation of state that includes a CEP in the universality class of the Ising model.

Parallel Session II (1)：TeV and BSM Physics / 60

Long-lived neutral scalar searches at FASER

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The ForwArd Search ExpeRiment (FASER), is a recently proposed experiment at the LHC that can detect light, long-lived particles. In this work we study the prospect of detecting light CP-even and CP-odd scalars at the FASER. We develop the general formalism for the scalar production and decay from mesons at LHC, given modified couplings of the scalars to the SM particles, as well as summarizing the relevant GeV-scale experiment constraints. We then analyze the light scalars in the large $\tan\beta$ region of the Type-I 2HDM, in which a light scalar with relatively long life time could be accommodated.

Summary:

Parallel Session V (3)：Heavy Ion Physics / 62

Probing QCD critical point and induced gravitational wave by black hole physics

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The Quantum Chromodynamics (QCD) phase diagram involves the behaviors of strongly interacting matter under extreme conditions and remains an important open problem. Based on the non-perturbative approach from the gauge/gravity duality, we construct a family of black holes that provide a dual description of the QCD phase diagram at finite chemical potential and temperature. The thermodynamic properties from the model are in good agreement with the state-of-the-art lattice simulations. We then predict the location of the critical endpoint and the first-order phase transition line. Moreover, we present the energy spectrum of the stochastic gravitational-wave background associated with the QCD first-order transition, which is found to be detected by IPTA and SKA, while by NANOGrav with less possibility.

Parallel Session IX (2)：Hadron and Flavor Physics / 63

Extending Precision Perturbative QCD with Track Functions

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合作者： Hao Chen [1]; Hua Xing Zhu [1]; Ian Moult [2]; Max Jaarsma [3]; Wouter Waalewijn [3]

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高能实验中，相比于量能器，trackers 上的测量具有更好的角度分辨率、能消除 pileup，使得测量结果更精确。但理论微扰计算中，只考虑带电粒子（tracks）的观测量不是红外安全的，这说明基于带电粒子的观测量的计算需要考虑非微扰效应。所以，一个类似于碎裂函数的非微扰量被引入进来，称为 track function，它能吸收微扰计算部分的红外发散。与碎裂函数不同的是，track function 描述的是从一个硬部分子形成的喷注中带电强子的总能量分布，而不仅仅是单个强子的能量分布，这使得 track function 的重整化群演化形式比碎裂函数的要复杂，是非线性的。我们获得了 track function 的α_s^2 阶演化方程，同时，该方程第一次给出了α_s^2 阶的双强子碎裂函数演化方程、三强子碎裂函数演化方程等等，当然，该方程也可以退化成为传统的（单强子）碎裂函数的 DGLAP 演化方程。这为精度喷注子结构的研究铺路。另外，track function 的α_s^2 阶演化方程在矩空间下的表达式及其在能量关联函数中的应用，相关讨论与结果已发表在 PRL 上（https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.128.182001）。

Parallel Session VII (5)：Particle Detector Technology / 64

The R&D of ultra fast MCP-PMT

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Small-size Micro-Channel-Plate Photomultiplier (MCP-PMT) has attracted extensive attention in the fields of high-energy physics, medical imaging and biological detection due to its ultrafast temporal resolution. We introduce the R&D of novel MCP-PMT with ultrafast rise time (RT) and transit time spread (TTS), which is called fast timing PMT (FPMT). We mainly introduce two kinds of FPMTs, including the single anode FPMT and 8X8 anodes FPMT. The time performance of FPMTs are optimized by simulation and experiments. The results show that by optimizing the structure of FPMT, the RT of single-anode FPMT is greatly improved from nanosecond level to picosecond level, and the TTS is also bettering from 71 ps to 35.8 ps. Furthermore, by improving the partial voltage of each electrode of the FPMT, the RT and TTS were also further optimized. The time performance and uniformity of 8X8 anodes FPMT will be be introduced in detail.

Parallel Session IV (3)：Heavy Ion Physics / 65

Fluctuations of conserved charges in strong magnetic fields

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strong magnetic fields are created at the early stage of non-central heavy-ion collisions. However, whether the magnetic fields survive in the late stage of heavy-ion collisions and experimental measurements of various observables are reminiscent of the initially-created magnetic fields still remains elusive. In this talk we show that fluctuations of and correlations among net baryon number, strangeness and electrical charge can be useful to probe the imprint of the magnetic field in heavy-ion collisions. This is based on the fact that 1) these fluctuations and correlations have been shown to be very useful in understanding the QCD phase structure in the vanishing magnetic fields and 2) our very recent lattice QCD studies on these quantities in magnetic fields.

We will show the first lattice QCD results of the second-order fluctuations of and correlations among net baryon number, electric charge and strangeness in (2+1)-flavor lattice QCD in the presence of a background magnetic field. Lattice QCD simulations are performed on $32^3 \times N_\tau$ lattices using the highly improved staggered fermions in a fixed scale approach with N_τ∈[8,96] [1,2]. We study these quantities from zero temperature up to ~1.7 T_{pc} with 15 values of the magnetic field strength eB∈[0,60 m_π^2] with pion mass m_π^2=220 MeV 1. We also extend the above lattice QCD studies to the realistic case with physical pion mass m_π^2=135 MeV, and focus on a smaller temperature interval around the pseudo-critical temperature ranging from 0.9 T_{pc} to 1.1 T_{pc}. To mimic the magnetic field strength produced in the early stage of heavy-ion collision experiments we now have 6 different values of the magnetic field strength up to ~10m_π^2 with m_π^2=135 MeV 3.

We discuss the temperature and □□ dependences of the second-order fluctuations of and correlations among net baryon number, electric charge and strangeness. We find that these second-order fluctuations and correlations are substantially affected by □□. They even develop peak structures at sufficiently large □□ which could be related to a possible critical end point in the □–□□ plane. We propose to investigate these quantities in experiments in different centrality classes and collision systems where □□ could be different.

1 Eur. Phys. J. A 57 (2021) no.6, 202

2 H.-T. Ding, S.-T. Li, A. Tomiya et al, Phys. Rev. D 104 (2021) 014505.

3 H.-T. Ding, S.-T. Li, J.-H. Liu and X.-D. Wang, work in progress.

Parallel Session VI (1)：TeV and BSM Physics / 66

Measurement of the electroweak production of Zγ and two jets in proton-proton collisions at sqrt(s) = 13 TeV and constraints on anomalous quartic gauge couplings

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The first observation of the electroweak (EW) production of a Z boson, a photon, and two forward jets (Zγjj) in proton-proton collisions at a center-of-mass energy of 13 TeV is presented. A data set corresponding to an integrated luminosity of 137 fb^{-1}, collected by the CMS experiment at the LHC in 2016-2018 is used. The measured fiducial cross section for EW Zγjj is $\sigma_{\mathrm{EW}} = 5.21 \pm 0.52\,(\mathrm{stat}) \pm 0.56\,(\mathrm{syst})\,\mathrm{fb} = 5.21 \pm 0.76\,\mathrm{fb}$. Single-differential cross sections in photon, leading lepton, and leading jet transverse momenta, and double-differential cross sections in m_{jj} and $|\Delta\eta_{\mathrm{jj}}|$ are also measured. Exclusion limits on anomalous quartic gauge couplings are derived at 95\% confidence level in terms of the effective field theory operators M_0 to M_5, M_7, T_0 to T_2, and T_5 to T_9.

Summary:

This paper presents the first observation of the electroweak (EW) production of a Z boson, a photon, and two jets (Zγjj) in $\sqrt{s} = 13$TeV proton-proton collisions recorded with the CMS detector in 2016–2018 corresponding to an integrated luminosity of 137 fb^{-1}. Events were selected by requiring two opposite-sign leptons with the same flavor from the decay of a Z boson, one identified photon, and two jets that have a large separation in pseudorapidity and a large dijet mass. The measured cross section in the fiducial volume for EW Zγjj production is $5.21 \pm 0.52\,(\mathrm{stat}) \pm 0.56\,(\mathrm{syst})\,\mathrm{fb} = 5.21 \pm 0.76\,\mathrm{fb}$, and the fiducial cross section of EW and QCD-induced production is $14.7 \pm 0.80\,(\mathrm{stat}) \pm 1.26\,(\mathrm{syst})\,\mathrm{fb} = 14.7 \pm 1.53\,\mathrm{fb}$. Both the observed and expected signal significances are well in excess of 5 standard deviations. Differential cross sections for EW and EW+QCD are measured for several observables and compared to standard model predictions computed at leading order. Within the uncertainties, the measurements agree with the predictions. Constraints are set on the effective field theory dimension-8 operators M_0 to M_5, M_7, T_0 to T_2, and T_5 to T_9, giving rise to anomalous quartic gauge couplings. These constraints are either competitive with or more stringent than those previously obtained.

Parallel Session IV (3)：Heavy Ion Physics / 67

Normalization of two-particle correlation observables

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To account for the acceptance effect of two-particle correlations, a normalization is performed in pioneer work. We propose a normalization scheme based on an independent particle assumption to improve the background estimation. Choosing per-trigger yield calculated by CGC as an example, a comparison of the background proposed in this paper with that in pioneer work is made. The differences between the two backgrounds are demonstrated to be small. However, the resulting per-trigger yield normalized by the two backgrounds show qualitative differences, i.e. different trends as a function of Δy. The one normalized by the background of this paper shows better agreements with data. The normalization does not affect the yield as a function of Δφ and thus the agreement of the per-trigger yield as a function of Δφ with the experimental data is maintained.

Parallel Session VII (5)：Particle Detector Technology / 68

20 英寸 MCP-PMT 的磁屏蔽设计

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一种新研制的具有良好时间响应的国产 20 英寸光电倍增管采用微通道板替代传统的倍增打拿级。我们使用了包裹在薄的 PET 中的高磁导率铁基非晶材料柔性薄片保护光电倍增管免受地磁场的影响。水切伦科夫探测器阵列中的数据分析结果表明，采用磁屏蔽后，探测效率平均提高了 87%；并且时间谱中来自于 MCP 基板上产生的二次电子的成分，相对于无磁屏蔽的情况下减少了 50%。

Parallel Session X(1)：TeV and BSM Physics / 71

A search for heavy Higgs bosons decaying into vector bosons in same-sign two-lepton final states in pp collisions at $\sqrt{s} = 13$˜TeV with the ATLAS detector

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A search for heavy Higgs bosons decaying into a pair of vector bosons and produced in association with a vector boson is performed, using final states with two leptons of the same electric charge (electrons or muons), missing transverse momentum and jets. A data sample of proton-proton collisions at a centre-of-mass energy of 13 TeV recorded with the ATLAS detector at the Large Hadron Collider between 2015 and 2018 is used. The data correspond to a total integrated luminosity of 139 fb^{-1}. The observed data are in agreement with Standard Model background expectations. The results are interpreted using higher dimensional operators in an Effective Field Theory. The upper production cross-section limits at 95% confidence level are calculated as a function of the heavy Higgs boson mass and coupling strengths to vector bosons. Limits are set in the Higgs boson mass region 300 to 1500 GeV, and depend upon the assumed couplings. The highest heavy Higgs boson mass excluded with the coupling combinations explored is 900 GeV. Limits on coupling strength are also provided.

72

Quantum kinetic theory for dynamical spin polarization from QED-type interaction

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We investigated the dynamical spin polarization of a massless electron probing an electron plasma in locally thermal equilibrium via the Moller scattering from the quantum kinetic theory. We derive an axial kinetic equation delineating the dynamical spin evolution in the presence of the collision term with quantum corrections up to \mathcal{O}(\hbar)O(ℏ) and the leading-logarithmic order in coupling by using the hard-thermal-loop (HTL) approximation, from which we extract the spin-polarization rate induced by the spacetime gradients of the medium. When the electron probe approaches local equilibrium, we further simplify the collision term into a relaxation-time expression. Our kinetic equation may be implemented in the future numerical simulations for dynamical spin polarization.

Parallel Session VII (3)：Heavy Ion Physics / 73

the Distribution of J/ψ under the Influence of Quark-gluon Plasma

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We study the hot-medium effects on charmonium.
Previously most work were focused on the medium effects
on the gluon propagator of the charmonium, but ignored that on the c quark and $\bar{c}$ anti-quark.
However, the hot medium interacts with not only gluons but also
quarks. Here we study the hot-medium effects on both c, $\bar{c}$ and
the transferred gluon based on two-particle fractal model.
We analyze the probability and entropy of the charmonium
from quark and charmonium aspects. We solve the probability and entropy
equations and obtain the medium influencing factor q_{gQ} and q_Q.
The factor q_{gQ} and q_Q reflect medium effects on gluons
and heavy quarks and on heavy quarks respectively.
It is found q_{gQ} and q_Q are both more than 1.
This implies that the hot medium influence both the transferred gluon and heavy quarks.
When increasing the temperature q_{gQ} and q_Q are found to deviate more from 1.
This illustrates the hot medium influence charmonium more at higher temperature.
We calculate the value of q_{gQ} at critical temperature and obtain
the transverse momentum spectrum of J/ψ.
Our result shows a good agreement with the experimental data.
The two-particle fractal model can be used to study other
mesons and tetraquark system in the future.

Parallel Session VII (3)：Heavy Ion Physics / 74

Measurement of the inclusive, prompt and non-prompt J/ψ production in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV with ALICE

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Quarkonium production is a direct probe of deconfinement in heavy-ion collisions. For J/ψ, a bound state of $c\bar{c}$ quarks, the (re-)generation is found to be the dominant production mechanism at low transverse momentum (p_{T}) and in central collisions at the LHC energies.
In addition, the non-prompt component of J/ψ production from b-hadron decays allows one to access the interaction of b-hadrons with the QGP down to low transverse momentum.

In this talk, the measurements of the J/ψ nuclear modification factor R_{AA}, as a function of centrality and p_{T} in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV will be shown. Prompt and non-prompt J/ψ production measurements at midrapidity($|y| < 0.9$), will be presented exploiting the whole data sample collected from Run 2. The prompt/non-prompt separation extends down to very low p_{T} and its precision is improved significantly compared to the previous publications. All the results will be compared with model calculations.

Parallel Session V (3)：Heavy Ion Physics / 75

Nonuniform-temperature effects on the phase transition

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At RHIC, a fireball forms in the Au-Au collision and rapidly cools during expansion, inside which the QCD matter undergoes a phase transition from quark-gluon-plasma to the hadronic phase. The phase transition signals are expected to be observed via the measurement of fluctuations of conserved charges such as baryon numbers 1. Indeed, both the dynamical evolution and the spatially-nonuniform-temperature (and chemical potential) distribution of the fireball
affect the fluctuations of QCD phase transition. However, the current studies of the QCD phase transition mainly focus on the dynamical effects 2, and the nonuniform-temperature effects are overlooked.

In this talk, we will present the spatially-nonuniform-temperature effects on the QCD phase transition temperature, the fluctuations, and the correlation length via a simplified Ising-like model 3. Different from the dynamical effects, which delay the phase transition, we reveal that the nonuniform-temperature effects lead to higher phase transition temperature. Besides, the suppression of the critical fluctuation can be as stronger as the dynamical slowing down effects, and the nonzero-momentum modes of fluctuations play a crucial role. Our study presents a different perspective to understand the recent STAR data and lattice results [4], and can be further generalized to other temperature-nonuniform systems like the compact stars.

1 J. Adamet al. (STAR Collaboration), Phys. Rev. Lett.126,092301 (2021).

2 M. Stephanov and Y. Yin, Phys. Rev. D98, 036006 (2018).

3 Jun-Hui Zheng and Lijia Jiang, Phys. Rev. D 104, 016031 (2021).

[4] A. Bazavovet al.(HotQCD Collaboration), Phys. Lett. B795,15 (2019).

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 76

D-wave excited cscs tetraquark states with JˆPC=1++ and 1+-

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We study the mass spectra of D-wave excited cs\bar{c}\bar{s} tetraquark states with J^PC=1++ and 1+− in both symmetric and antisymmetric color configurations by using the QCD sum rule method. We construct the D-wave diquark-antidiquark type of cs\bar{c}\bar{s} tetraquark interpolating currents in various excitation structures with (Lλ,Lρ{lρ1,lρ2})=(2,0{0,0}),(1,1{1,0}),(1,1{0,1}),(0,2{1,1}),(0,2{2,0}),(0,2{0,2}). Our calculations support the recent observed X(4685) resonance to be a D-wave csc¯s¯ tetraquark state with JPC=1++ in (0,2{1,1}) excitation mode. We suggest to search for these possible D-wave csc¯s¯ tetraquarks in both the hidden-charm channels J/ψϕ, ηcϕ and open-charm channels such as DsD∗s, DsD∗s1 and so on.

Parallel Session V (5)：Particle Detector Technology / 77

基于声子探测的新型钼酸盐低温晶体量热器研制

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基于声子探测的新型荧光-热量双读出低温晶体量热器是近年新发展起来的革命性探测技术，具有极高的灵敏度，极低的探测器阈值（20eV），极好的能量分辨（FWHM 5keV@2615keV），独特的粒子鉴别能力，在低本底实验、稀有物理衰变中有广泛的应用前景。报告主要介绍在科大研制钼酸盐低温晶体量热器，在 10mK 深冷环境下，通过半导体声子传感器及科大自主研制的初级低温低噪声小信号电子学系统，成功读出宇宙线能量沉积产生的荧光-热量二维信号；及其后续优化升级计划，以期获得高性能低温晶体量热器及地面深冷测试平台。

Summary:

Parallel Session I (2)：Hadron and Flavor Physics / 78

Study of the pentaquark states

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Inspired by the observations of the pentaquark-like states found by LHCb, we investigated these heavy pentaquark states with the coupled channel unitary approach, taking into account the heavy quark spin symmetry and local hidden gauge symmetry. We dynamically reproduced three P_c states and $P_{cs}(4459)$ in the interactions of the channels $\bar{D}^{(*)}\Sigma_c^{(*)}$ and $\bar{D}^{(*)}\Xi_c^{(*,')}$ with their coupled channels, respectively. Furthermore, we also show the results on the two-poles structure of the $\Lambda(1405)$ state in the interactions of $\bar{K}N$ and $\pi\Sigma$ with their coupled channels. Thus, one concluded that these resonances were molecular states.

Parallel Session VII (3)：Heavy Ion Physics / 80

高重子密度区金核-金核碰撞中的奇异强子产生/Strange hadron production in Au+Au collisions at high baryon density

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Strangeness production has been suggested as a sensitive probe to the early-time dynamics of the nuclear matter created in heavy-ion collisions. Transverse momentum distributions and yields of strange hadrons provide important information about the particle production mechanisms and help us to understand the properties of the created medium and its evolution in these collisions. RHIC Beam Energy Scan (BES) program covers a wide range of energies from $\sqrt{s_{\rm NN}} = 200$ GeV to 3 GeV. Of particular interest is the high baryon density region which is accessible through the STAR fixed-target (FXT) program, extending the energy reach down to 3 GeV.

This presentation will report on the first measurements of strange hadron production in Au+Au collisions at $\sqrt{s_{\rm NN}} = 3$ GeV. These results include the transverse mass spectra, rapidity density distributions, particle ratios, and their centrality dependence of strange hadrons (K^-, K^0_S, ϕ, Λ, Ξ^-). The kinetic freeze-out properties of the created medium will be discussed. These new results will be compared with those from higher collision energies and discussed within the framework of model calculations.

Parallel Session IX (1)：TeV and BSM Physics / 85

Dark magnetic dipole property in fermionic absorption

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In this talk, I will present our recent work [arXiv: 2201.11905] about detecting the dark magnetic dipole through fermionic dark matter (DM) absorption. In this work, we propose a Dirac fermion DM charged under a dark gauge group and with the dark magnetic dipole operator. Under the mixing of DM and right-handed neutrino, it induces the process that the incoming DM is absorbed and converted into neutrino in final state through the dipole-charge interaction. Such absorption process provides a more distinctive peak-like signal than the ordinary elastic scattering at sub-GeV scale.

Firstly, in this talk, we will quickly review the relevant studies about fermionic DM detection by others in recent years and talk about our motivation. Then we will discuss the characteristics of absorption process for nucleus and bound electron target. The procedure of our numerical calculations will also be mentioned. Finally, we will present the prospective bounds on dark magnetic dipole in the mode.

Parallel Session VIII (2)：Hadron and Flavor Physics / 86

Hadronic molecule $\eta_1(1855)$ and its $SU(3)$ partners

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The newly reported $\eta_1(1855)$ with $J^{PC}=1^{-+}$ is interpreted to
be a dynamically generated pole in $f_1(1285)\eta - K_1(1400)\bar{K}$
scattering with Weinberg-Tomozawa term serves as interaction.
When $a_1-\pi$ mixing in axial meson dominance model is included,
the ratio in $\eta_1(1855)$ decaying into
final states $\eta\eta'$ and $K^*\bar{K}\pi$ is around
$\left(0.54^{-0.20}_{+0.35}\right)^A$ or $\left(0.37^{-0.14}_{+0.33}\right)^B$ in
choices on the mixing angles in 1^+ mesons.
Furthermore, its $SU(3)$ partners are studied as well,
where $\pi_1(1600)$ may correspond to a pole in $f_1(1420)\pi - K_1(1270)\bar{K} - K_1(1400)\bar{K}$ scattering and
the pole generated in $f_1(1285)K - K_1(1270)\eta$ scattering relates to a sharp jump in ϕK^+ invariant
mass
distributions in $B^+\to J/\psi\phi K^+$, latter of which can decay into ηK and be a good way
to test the explanation of hadronic molecule in 1^{-+} meson spectrum below $2000\,\mathrm{MeV}$.

Parallel Session V (1)：TeV and BSM Physics / 87

Gravitational waves from axion and related searches

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We discuss the axion objects such as axion mini-clusters and axion clouds around spinning black holes, which induce parametric resonances of electromagnetic waves through the axion-photon interaction, as well as high frequency gravitational waves through gravitational Chern-Simons (CS) coupling. We also present some new detection schemes for axions and high frequency waves.

Parallel Session II (3)：Heavy Ion Physics / 91

The recent results of collective flow from Beam Energy Scan II at RHIC-STAR

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Collective flow is a notable probe of studying the properties of the medium created in heavy ion collisions. Directed and elliptic flow, v_1 and v_2, are sensitive to the dynamics at the early stage of

the system evolution and equation of state of the medium. The triangular flow v_3 provides complementary information on the initial geometry fluctuations and transport properties of the medium. The hadronic interaction cross sections of multi-strange hadrons and φ mesons are expected to be small and their freeze- out temperatures are close to the transition temperature between quark and hadronic matter. Hence, these hadrons may provide information primarily from the early stage of the high energy collisions.

From the measurements based on the first phase of RHIC beam energy scan (BES-I), we observed that v_1 slopes (dv_1/dy) at mid-rapidity region for net-proton and net-Λ show a minimum value around $\sqrt{s_{NN}}$ = 10 - 20 GeV. The v2 of φ mesons seems to be lower at $\sqrt{s_{NN}}$ = 7.7 and 11.5 GeV compared to other charged hadrons. In this talk, with the much-enhanced statistics from the second phase of RHIC beam energy scan (BES-II) dataset, we present precision measurements of v_1, v_2, and v_3 for (multi-)strange hadrons at $\sqrt{s_{NN}}$ = 3 - 19.6 GeV with both fixed-target and collider modes at STAR. Implications of these measurements on the QCD phase structure at high $_B$ region are discussed.

Parallel Session III (3): Heavy Ion Physics / **92**

Probing the valence quark region of nucleons with Z bosons at LHCb

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The unique forward coverage of the LHCb spectrometer allows the valence quark distributions of protons and nuclei to be probed with unprecedented precision. In this high-x region, both the flavour content and structure of the nucleon's parton distribution functions remain relatively poorly known. New LHCb measurements of Z+charm jet production could be indicative of a valence-like intrinsic-charm component in the proton wavefunction, and measurements of Z production in pPb collisions provide new constraints on the partonic structure of nucleons bound inside nuclei. Here we will discuss these new LHCb measurements and comparisons with state-of-the-art parton distribution function calculations.

Parallel Session IX (2)：Hadron and Flavor Physics / **94**

Polarized vector meson production in semi-inclusive DIS

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We make a calculation for polarized vector meson production SIDIS by considering the general case of neutral current electroweak interactions. We present a kinematic analysis for the process and show that the cross section is expressed by 81 structure functions. We further make a QCD parton model calculation at the leading twist and present the structure functions results in terms of the TMD parton distribution functions and fragmentation functions. The results show that 27 structure functions are nonzero at this level, among which 15 are related to the tensor polarization of the vector meson. Thirteen structure functions are generated by parity-violating effects. We also carry out a rough numerical estimate for the spin alignment of the K^{*0} vector meson.

Parallel Session VII (3)：Heavy Ion Physics / 96

Recent light hypernuclei measurements from STAR experiment

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Different from normal nuclei, hypernuclei are bound states of nucleons and hyperons, which contains strange quarks. The hyperon-nucleon (Y-N) interaction, an important ingredient for the nuclear equation-of-state (EoS), remains poorly constrained. Precise measurements of hypernucei intrinsic properties, and production yields in heavy-ion collisions are crucial to the investigation of their production mechanisms and the strength of the Y-N interaction. Model calculations predict that hypernuclei are abundantly produced at low energies due to high baryon density.

Thanks to the high statistical data taken from the STAR BES II program in 2018-2021, a series of measurements on production yields and properties of light hypernuclei (^{3}H, ^{4}H, ^{4}He) at low energies will be presented. The results will be compared with model calculations and physics implications will be discussed.

Parallel Session II (5)：Particle Detector Technology / 97

MIP timing detector at the CMS experiment

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The HL-LHC will run with 5 times higher instantaneous luminosity than the LHC. Severe pileup effect significantly degrades the physics sensitivities. MIP timing detector (MTD) is designed to provide precise measurement of the timing of MIPs to the level of 30 ps, and can bring remarkable identification performance of pileup vertices, which keeps the HL-LHC physics programs attractive. This talk will introduce the design of MTD, particularly for the barrel, and will report the current status of the Chinese participation in this upgrade program.

Parallel Session III (5)：Particle Detector Technology / 98

Research Progress of The Glass Scintillator

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The Circular Electron Positron Collider (CEPC) is a large international scientific facility proposed by the Chinese particle physics community. The proposal of silicon photomultiplier (SiPM) coupling with the glass scintillator as the detection unit HCAL is a new solution for the next generation calorimeter. In order to achieve the goal of high density and high light yield of the glasses. Glass Scintillators RD; Group has prepared and researched a large number of scintillating glasses. Among them, the highest light yield can reach 1600 photons/MeV, and the best energy resolution is 19.64%@662keV.Further improvements in light yield and exploration of high-density glass systems are the next phase of the plan.

Summary:

A large number of scintillation glasses were prepared and their scintillation properties were studied for HCAL of CEPC. The highest light yield of the glasses can reach 1600 photons/MeV. Glass Scintillators R&D Group will continue to improve the light yield and density of the scintillating glasses.

Parallel Session VI (3)：Heavy Ion Physics / 99

QCD Matter in electromagnetic field

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We calculate color screening mass in a thermalized and magnetized QCD matter in the frame of resummed perturbation theory, without restriction to the strength of the magnetic field $|qB|$. Different from the Debye screening in classical electrodynamics, the quantization of the quark transverse momentum $p_\perp^2 = 2n_L|qB|$ in the external magnetic field with the integer n_L describing the Landau energy level is naturally embedded into the quark loop and in turn the screening mass. In this sense, we call the color screening as quantum screening. Our calculation comes back to the well-known results in the limits of weak and strong magnetic field.

Parallel Session IV (5)：Particle Detector Technology / 100

面向正负电子对撞机物理的时间投影室径迹探测技术 (TPC) 研究进展

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研究基本粒子性质及相互作用是当今物理学发展的前沿领域之一。近年来，国际上提出直线对撞及环形对撞等多种方案，如 ILC（Internationale Linear Collider），FCC-ee（Future Circular Collider-ee）等正负电子对撞机项目。国内高能物理界提出可研究 Higgs 物理和 Z 物理的环形正负电子对撞机（Circular Electron Positron Collider, CEPC）概念设计，物理目标对径迹探测器的设计和优化提出了严格的要求，不断提高的物理需求对径迹探测器性能提出更高的技术需求，时间投影室（Time Projection Chamber, TPC）是核心径迹探测器的一个重要选项。目前国内外已经开展了面向 100 微米（σ）精度需求的探测器模块相关研究，在解决高分辨及正离子反馈问题的同时，需要实现相关参量的原型机实验研究，基于以上物理问题，通过时间投影室模块、原型机的实验研究，分析解决关键的技术和物理问题。

本报告面向正负电子对撞机物理的时间投影室径迹探测技术 (TPC) 研究进展，以目前时间投影室研究中的热点问题为切入点，对正离子反馈引起的空间电荷效应、空间位置畸变、长径迹动学空间下的粒子鉴别能力、探测器畸变校正等问题进行了研究。研究首先利用了 Mokka 和 Comsol 分析研究了在不同亮度和反馈离子数下，空间电荷效应对于空间位置的影响。结合相关的实验研究，得出读出模块保证正离子反馈的定量关系。为了实现正负电子对撞机物理的时间投影室径迹探测物理目标，研究利用 266nm 激光研究了实验投影室原型机的激光径迹重建、空间点及径迹位置分辨率，分析了电离能损分辨率和漂移速度测量及电场畸变修正方法。并通过全尺寸 TPC 电离能损分析测试结果得出：对应于一个最小电离粒子测量，该 220 个空间点的全尺寸时间投影室的 ⌧⌧/⌧⌧ 分辨率可以达到 3.6%，并且位置分辨率可以达到$\mathcal{O}$(<100μm) (2T)；为面向更高对撞亮度的物理需求，以及粒子鉴别（Particle Identification Detection, PID）的物理需求，同时与 LCTPC（International Linear Collider Time Projection Chamber Collaboration）国际合作组，本报告也给出像素型读出时间投影室径迹探测技术 (TPC) 实验研究进展现状。

Summary:

Parallel Session V (5)：Particle Detector Technology / 103

基于闪烁光纤和硅光电倍增管的大面积宇宙线测试平台研制

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为了满足 HERD 项目研制中探测器性能标定需求，基于闪烁光纤和硅光电倍增管设计了大面积宇宙线测试平台，开展了原理样机研制并进行了初步的性能测试。首先进行了单根光纤性能研究，测试了不同反射材料和耦合方式下的光纤读出信号分布，优选了光输出高的光纤处理方案，并研究了国产 SiPM 的性能。三层直径 1mm 的闪烁光纤交错排列构成宇宙线灵敏层，入射宇宙线穿过闪烁光纤阵列并在其中沉积能量产生闪烁光信号。硅光电倍增管拼接成长条阵列用于读出闪烁光纤的输出信号，单片硅光电倍增管面积为 3mm*3mm，包含 3 路读出通道。完成了宽度 5cm 长度 100cm 的闪烁光纤阵列研制以及 10 片 SiPM3 路读出通道阵列研制，光纤板和 SiPM 通过硅油耦合组装完成第一个原理样机。利用两台 DT5742 搭建了 32 路波形采样测试数据获取系统，对原理样机进行了数据采集。对该原理样机利用宇宙线进行了 MIP 探测效率测试，MIP 信号在 SiPM 通道产生的信号大于 10 个光电子，能有效和 SiPM 的暗噪声进行区。经过分析得到该样机沿着光纤长度方向 MIP 探测效率均大于 99%，能很好满足应用需求。

Summary:

Parallel Session I (5)：Particle Detector Technology / 104

R&D progress of high granularity HCAL for CEPC

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Based on the particle-flow paradigm, a novel hadronic calorimeter (HCAL) with high granularity is proposed to address major challenges from precision measurements of jets at future lepton collider experiments, such as the Circular Electron Positron Collider (CEPC). Two technical options have been considered for the HCAL design: one is the digital readout scheme (DHCAL), which uses either glass resistive plate chambers (GRPC) or thick gas electron multiplier detectors (THGEM) as the active medium; the other is the analog readout scheme (AHCAL), which uses either plastic scintillators or glass scintillators as the active medium. Among all these designs, the glass scintillator HCAL design aims for further significant improvements of the hadronic energy resolution as well as the particle-flow performance, especially in the low energy region (typically below 10 GeV for major jet components), with a notable increase of the energy sampling fraction due to its high density. A great number of efforts have been devoted to the HCAL design, including the construction and standalone simulation of HCAL prototypes as well as the full simulation in the CEPC software framework. Physics benchmark potentials with jets in the final state are also being evaluated using a Particle-Flow Algorithm (PFA), named “ArborPFA”. In this contribution, the latest R&D progress of high granularity HCAL, especially the glass scintillator scheme, will be introduced

Parallel Session V (3)：Heavy Ion Physics / 107

相对论重离子碰撞中 QCD 物质相图的实验研究

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理解强相互作用物质的性质及其相结构可以增进我们对宇宙演化和可见物质结构的认识，具有重要的科学意义。在过去的二十年里，人们在高能重离子碰撞中观测到许多强相互作用的夸克-胶子等离子体（sQGP）的间接实验证据。因此，探索高重子密度下的 QCD 相结构，如绘制出一阶相变边界和寻找 QCD 临界点在相图中的位置，成为高能重离子碰撞的最重要目标之一。从 2010 到 2021 年，RHIC-STAR 实验完成了两个阶段的重离子碰撞能量扫描计划, 采集了从质心能量 200 GeV 到 3 GeV 各种下 Au+Au 碰撞实验数据。本次报告中，将集中讨论最近在 RHIC-STAR 实验中探索 QCD 相结构、寻找 QCD 临界点的实验研究进展

Parallel Session VII (3)：Heavy Ion Physics / 108

J/ψ azimuthal anisotropy in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV in STAR

作者： Qian Yang[1]

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Charm quark serves as an important hard probe for studying the properties of the Quark Gluon Plasma (QGP). Measurements of J/ψ anisotropy flow is a powerful tool to understand the interaction between charm quark and the QGP. With the high-statistics 200 GeV Ru+Ru and Zr+Zr collision data collected by the STAR experiment, J/ψ anisotropy flow are measured as a function of p_T and

centrality. The non-flow contributions are highly suppressed by using the Event Plane Detector. The comparison to model calculations, as well as previous experimental results at RHIC and LHC will be discussed.

Parallel Session I (3)：Heavy Ion Physics / 109

喷注物理实验综述

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The energy loss of jets (jet quenching) is one of the most important signatures of the deconfined state of quarks and gluons (Quark-Gluon Plasma) created in Pb–Pb collisions at the LHC. The measurement of jets recoiling from a trigger hadron uniquely enables the exploration of medium-induced modification of jet production. Jet deflection via multiple soft scatterings with the medium constituents may result in a broadening of the overall azimuthal correlation between the trigger hadron and the recoiling jet. In addition, the tail of this azimuthal correlation is sensitive to single-hard Moli\'ere scatterings off quasi-particles in the medium. The overall yield and R-dependence of the recoil jets of also offers important information about jet energy loss and intra-jet broadening.

This contribution presents a measurement of charged jets recoiling from a trigger hadron in pp and Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV. Techniques are employed which allow for a precise data-driven subtraction of the large uncorrelated background contaminating the measurement in Pb–Pb collisions, enabling the exploration of medium-induced modification of jet production and acoplanarity over a wide phase space, including the low jet p_{T} region for large jet resolution parameter R.

Parallel Session VIII (5)：Particle Detector Technology / 110

CEPC 同步辐射研究进展

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摘要
继 Higgs 粒子在欧洲核子研究中心被发现以后，为了更加精细的探索与研究 Higgs 的各种性质，深入研究电弱对称性自发破缺机制、质量起源、宇宙早期演化等基本问题，并探索超出标准模型的新物理。中国科学家提出在本土建造一个周长为 100km 以 Higgs 工厂为主，在多种模式下运行的大型环形对撞机 CEPC。而环形对撞机在运行时最不可忽略的就是磁铁弯曲而引起的同步辐射造成的本底影响。本文从 CDR 参数出发，进行了同步辐射模拟，并根据设计工况及屏蔽需求设计不同方案来优化同步辐射屏蔽。同时针对不同设计方案，进行了初步的探测器模拟。

Parallel Session VII (2)：Hadron and Flavor Physics / 111

High Precision Proton Charge Radius Experiments at Jefferson Lab

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In 2010, a new method using muonic hydrogen spectroscopy led to a proton charge radius (r_p) result that was nearly ten times more precise but significantly smaller than results obtained using the two traditional methods, namely $e-p$ elastic scattering and ordinary Hydrogen spectroscopy. This discrepancy triggered the so-called "proton charge radius puzzle".
To investigate this discrepancy, the PRad collaboration performed a new experiment in 2016 in Hall B at the Thomas Jefferson National Accelerator Facility. With both 1.1 and 2.2 GeV electron beams, the experiment measured the $e-p$ elastic scattering cross sections in an unprecedentedly low values of momentum transfer squared region ($Q^2 = 2.1 \times 10^{-4} - 0.06\ (\mathrm{GeV/c})^2$), with a sub-percent precision. The PRad experiment utilized a magnetic-spectrometer-free setup, which was based on a large acceptance and high resolution calorimeter (HyCal), a plane of two large-area Gas Electron Multiplier (GEM) detectors, and a windowless H_2 gas-flow target. In this talk, I will discuss details of the data analysis and present the results of this experiment. I will also focus on the newly approved PRad-II experiment. Through a number of major upgrades to the experimental setup and analysis method, the new experiment aims to reduce the total uncertainty of r_p by nearly a factor of 4 compared to that of PRad.

Parallel Session II (3)：Heavy Ion Physics / 115

RHIC-STAR 能量扫描 II 中直接流的实验研究进展

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RHIC-STAR 的主要物理目标是研究夸克胶子等离子体（QGP）的性质及 QCD 相结构。格点 QCD 预言从强子到 QGP 相的相变存在一级相边界，而一级相边界终点是 QCD 临界点。定位一级相边界以及寻找相变临界点是当前 STAR 能量扫描实验的主要物理动机。集体流是研究 QCD 相结构的重要探针，本报告聚焦直接流 v1, 它是末态粒子在动量空间相对于反应平面方位角分布傅里叶展开式中的一阶系数，它描述重离子碰撞中产生粒子的侧向运动，携带碰撞早期的信息。由于 QGP 和强子相表现出不同的集体行为，因此直接流敏感于碰撞产生核物质的状态方程。
STAR 已经完成了对撞能量$\sqrt{s_{NN}}$= 7.7-200 GeV 的一期能量扫描计划（BES-I）。其中在$\sqrt{s_{NN}}$= 10-20 GeV 观察到净质子和净Λ 超子的直接流斜率（dv_1/dy）在中快度区有极小值。含有一级相变的流体力学计算表明，净重子直接流斜率的最小值被认为是强子相与 QGP 相之间相变的一个信号。BES-II 聚焦$\sqrt{s_{NN}}$= 3-19.6 GeV 的重离子碰撞，本报告将讨论 BES-II 中 π, K, p, Λ（$\overline{\Lambda}$）和ϕ 的直接流测量的最新结果。在 3 GeV 的重离子碰撞中，我们观察到粒子的直接流与高能重离子碰撞的显著不同，表明该能量下强子相互作用占据主导地位。

Parallel Session VI (5)：Particle Detector Technology / 117

高精度时间测量电子学技术研究进展

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在此报告中，计划介绍在大型粒子与核物理实验中报告人研究团队在高精度时间测量方向上的研究进展，包括基于高速波形数字化和高速甄别、时间数字变换两个技术方向上的研究工作。在技术方法简介和回顾基础上，介绍在提高电子学定时精度技术上的学术研究工作与最近进展，从硬件电路设计与算法研究两个方向展开陈述，并结合实际工程上的应用情况进行详细技术的介绍。

Parallel Session IX (5)：Particle Detector Technology / 121

Test of a prototype Topmetal chip for N⊠DEx experiment

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NνDEx is a recently proposed experiment to search for the neutrinoless double beta decay of ^{82}Se with high pressure SeF_6 gas TPC. The readout plane made of Topmetal-S chips is the key to achieve the desired 1\% FWHM energy resolution.
Two versions of the Topmetal-S chips, featuring the capability of direct ion charge detection without avalanche gain, have been designed and fabricated.
The design of both versions' chip will be presented. And the characterization results, which were tested by injecting pulses and radiation source, as well as the test system will also be described.

Summary:

Neutrinoless double beta decay experiment($0\nu\beta\beta$) is crucial to understand the property of neutrino, especially for its mass and Majorana/Dirac nature. NνDEx (No Neutrino Double-beta-decay Experiment) is a $0\nu\beta\beta$ search project using a high pressure SeF_6 gas time project chamber (TPC) in China JinPing underground Lab. SeF_6 has high electron affinity. There is virtually no free electron drifting in it. So the ions need to be directly collected without charge multiplication. The Topmetal-S chip, with its topmost metal for charge sensing, is designed for this purpose. To achieve the 1\% FWHM energy resolution while keeping a good tracking performance, the equivalent noise charge (ENC) of the topmetal-S chip is desired to be at <30 e level. More discussion about the advantage of using CMOS integrated sensors in $0\nu\beta\beta$ can be found in arXiv:2010.09226. The charge collected by the sensor of chip will be converted into voltage signal by charge sensitivity pre-amplifier (CSA) inside the chip. Six bias voltages in CSA are adjustable to allow fine tuning the work states of the CMOS transistors. So far two versions of the Topmetal-S chips have been designed and fabricated. The first version of the Topmetal-S is fabricated using X-FAB 350˜nm technology. The charge collection capability is confirmed. Two methods are used to measure the ENC. 1) Charge injection through pulse signals on the guard-ring. The amount of charge injected could be estimated using the capacitance of the guard-ring and the amplitude of the pulse. A new method is developed to precisely determine the capacitance of the guard-ring. The measured value is substantially different from the value extracted from the EDA software. 2) Using the 5.5˜MeV α and 59.5˜keV, 26˜keV γ rays from ^{241}Am decay. A small TPC using P10 gas is built for this test. The amount of charge induced by these radioactive rays could be calculated from their energies and the W value of P10 gas. Both methods show consistent results that the ENC of the first version Topmetal-S is in the range of 500-600 e^-, which is much larger than the design value. Further study shows that the CSA inside the chip is unstable and its open loop gain could not reach the designed value due to a defect in the design. The second version of the Topmetal-S chip, fabricated using GSMC 130˜nm technology, is developed to address the issues found in the first version. The characterization of the second version is on-going and the results will be presented at the conference. Further improvements and integration of other modules (e.g., network readout) is planed in the future versions. A final fully functioning version is expected to be ready in 2025 along with the road-map of NνDEx experiment.

Parallel Session III (5)：Particle Detector Technology / 122

R&D of a novel high-granularity crystal calorimeter

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In order to measure the Higgs boson, electroweak physics and the top quark with unprecedented precision, a sophisticated calorimetry system is vital for future electron-positron collider experiments. Based on the particle-flow paradigm, a novel highly granular crystal electromagnetic calorimeter (ECAL) is proposed to address major challenges from jet reconstruction and to achieve the optimal EM energy resolution of around $2-3\,\%/\sqrt{E(GeV)}$. This talk reviews R&D progress on a high granularity crystal ECAL readout with silicon photomultipliers (SiPMs) as it is being developed to fully exploit the physics potential of a lepton collider. The requirements on crystal candidates, SiPMs as well as readout electronics are parameterized and quantified in Geant4 full simulation. Experiments including characterizations of crystals and SiPMs have been followed to validate and improve the simulation. Recent results from development of small-scale detector modules are being presented. Physics performance of the crystal ECAL has been studied with the particle-flow algorithm "ArborPFA" which is being optimized. A dedicated reconstruction software is also being developed for a detector layout with long crystal bars arranged to be orthogonal to each other in every two neighbouring longitudinal layers.

Parallel Session V (5)：Particle Detector Technology / 124

液氩探测器关键技术研发进展

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报告主要分为两部分：

1. 吨级液氩暗物质探测器的结果报告:
   位于高能所的吨级液氩探测器是国内首个大型液氩探测器实验，共充装液氩约 2.22 吨，在国内首次实现吨量级液氩探测器的平稳运行。我将对该实验结果进行报告。
2. 液氩环境下的 Silicon Photo-multiplier（SiPM）信号读出系统的研发进展:
   目前，我们已经成功实现了 SiPM 阵列及其前端放大电子学在液氩环境下的稳定运行及信号读出，获得了由 SiPM 信号给出的 241Am 能谱。我将报告关于液氩环境中 SiPM 运行的最新进展。

Parallel Session V (3)：Heavy Ion Physics / 125

Chiral condensates and screening masses of neutral pseudoscalar mesons in thermomagnetic QCD medium

作者： Sheng-Tai Li[1]

合作者： Heng-Tong Ding [2]; Jun-Hong Liu [2]; Xiao-Dan Wang [2]

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We point out that chiral condensates at nonzero temperature and magnetic fields are in strict connection to the space-time integral of corresponding two-point neutral meson correlation functions in the pseudoscalar channel via the Ward-Takahashi identity. Screening masses of neutral pseudoscalar mesons, which are defined as the exponential decay of the corresponding spatial correlation functions in the long distance, thus are intrinsically connected to (inverse) magnetic catalysis of chiral condensates. To study this we performed lattice simulations of $(2+1)$-flavor QCD on $32^3 \times N_t$ lattices with pion mass $M_\pi \simeq 220$ MeV in a fixed scale approach having temperature $T \in [17, 281]$ MeV and magnetic field strength $eB \in [0, 2.5]$ GeV^2.
We find that screening lengths, i.e. inverses of screening masses of π^0, K^0 and $\eta^0_{s\bar{s}}$, turn out to have the similar complex eB and T dependences of the corresponding chiral condensates. Although the transition temperature is found to always decrease as eB grows, we show that the suppression due to magnetic fields becomes less significant for hadron screening length and chiral condensates with heavier quarks involved, and ceases to occur for $\eta^0_{s\bar{s}}$ and strange quark chiral condensate. The complex eB and T dependences of both screening masses and chiral condensates, reflecting the crossover nature of the QCD transition, are attributed to the competition between sea and valence quark effects. These findings could be useful to guide low-energy models and effective theories of QCD. This talk is based on 1.
1 Phys.Rev.D 105 (2022) 3, 034514

Parallel Session IX (2)：Hadron and Flavor Physics / 127

[Belle report] Search for a light Higgs boson in single-photon decays of Y(1S) using Y(2S)→pi+pi-Y(1S) tagging method

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We search for a light Higgs boson (A^0) decaying into a $\tau^+\tau^-$ or $\mu^+\mu^-$ pair in the radiative decays of $\Upsilon(1S)$.
The production of $\Upsilon(1S)$ mesons is tagged by $\Upsilon(2S) \to \pi^+\pi^-\Upsilon(1S)$ transitions, using 158 million $\Upsilon(2S)$ events accumulated with the Belle detector at the KEKB asymmetric energy electron-positron collider. No significant A^0 signals in the mass range from the $\tau^+\tau^-$ or $\mu^+\mu^-$ threshold to 9.2 GeV/c^2 are observed. We set the upper limits at 90% credibility level (C.L.) on the product branching fractions for $\Upsilon(1S) \to \gamma A^0$ and $A^0 \to \tau^+\tau^-$ varying from 3.8×10^{-6} to 1.5×10^{-4}.
Our results represent an approximately twofold improvement on the current world best upper limits for the $\Upsilon(1S) \to \gamma A^0(\to \tau^+\tau^-)$ production. For $A^0 \to \mu^+\mu^-$, the upper limits on the product branching fractions for $\Upsilon(1S) \to \gamma A^0$ and $A^0 \to \mu^+\mu^-$ are at the same level as the world average limits, and vary from 3.1×10^{-7} to 1.6×10^{-5}.
The upper limits at 90% C.L. on the Yukawa coupling $f_{\Upsilon(1S)}$ and mixing angle $\sin\theta_{A^0}$ are also given.

Parallel Session VIII (5)：Particle Detector Technology / 128

基于神经网络的高时间分辨 ECAL 读出电子学研究

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俄罗斯重离子对撞机 NICA 上的多功能探测器（Multi Purpose Detector，MPD）实验是中俄重大合作项目。清华大学工程物理系与国内几所高校基本完成了该实验中电磁量能器（Electromagnetic Calorimeter，ECAL）第一阶段的批量生产，并开展了针对 ECAL 下一代高时间分辨读出电子学的研究工作。在不改变硅光电倍增管（SiPM）和波形采样读出方案的情况下，为了降低功耗，并改善该系统的时间分辨能力，我们着手开发由大动态范围模拟前放、高采样率模数转换器（ADC）以及神经网络特征提取电路构成的读出电子学系统，用于 ECAL 下一阶段的升级。先期进行了各个组件的设计，以及神经网络特征提取算法的验证。在仿真研究的基础上，我们设计了基于分立器件的前放电路板，通过激光注入测试了电子学系统的本征时间分辨；同时，我们设计了两档模拟集成电路前放，高增益档和低增益档分别对高时间分辨和大动态范围进行了优化。为了有效处理 ADC 采样波形，神经网络特征提取电路采用了片上系统的结构，网络运算加速器作为一个外设挂载在 CPU 总线下。针对该片上系统，我们进行了软/硬件协同设计和功能仿真，并在 FPGA 平台上对读出系统的原型进行了验证。初步分析结果表明，该系统能以较低的功耗达到项目时间分辨要求，并且基于神经网络的方案具有更好的适配性和扩展潜力。

Summary:

在本报告中，我们首先介绍 ECAL 的项目背景，和现有读出电子学的情况；接着，讨论了基于高速 ADC 和神经网络的读出电子学方案，以及相关的软件模拟、实验数据分析工作和硬件系统的规划；然后，介绍各个组件的研究进展，包括前放的测试等；特别地，针对神经网络特征提取，分析了从算法到数字逻辑的实现流程，以及 FPGA 系统的验证情况。

Parallel Session IX (2)：Hadron and Flavor Physics / 129

Lattice QCD prediction of kaon electromagnetic form factor at large Q^2 up to 10 GeV^2.

作者： Qi Shi[1]

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Electromagnetic form factor, especially its asymptotic behavior for large momentum transfer (Q^2), of kaon provides crucial insight into the partonic structure of a Nambu-Goldstone boson in strong interaction. Studies of the electromagnetic form factor of kaon up to $Q^2 \sim 6$ GeV^2 are underway at the ongoing JLab12 experiment, and its measurements in an extended range of $Q^2 \sim 9 - 30$ GeV^2 are planned at the future Electron Ion Collider (EIC). For the first time, we will present results for the kaon electromagnetic form factor in the range of $Q^2 \sim 2 - 10$ GeV^2 from state-of-the-art lattice QCD calculations carried out using physical values of up, down and strange quark masses. These results will provide benchmark QCD predictions for model-based studies and the experimental measurements, in particular at the boundaries between the JLab12 and the EIC.

Parallel Session VI (2)：Hadron and Flavor Physics / 130

Exploring Partonic Collinear Structure and Light-Cone Distribution Amplitudes by Quantum Computing

作者： Dan-bo Zhang[1]; Enke Wang[1]; Hongxi Xing[1]; Shi-Liang Zhu[1]; Tianyin Li[1]; Wai Kin Lai[1]; Xiaohui Liu[2]; Xingyu Guo[1]

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This talk contains two parts, the first part is Partonic Collinear Structure by Quantum Computing and the second part is Exploring Light-Cone Distribution Amplitudes from Quantum Computing.

In the first part, we present a systematic quantum algorithm, which integrates both the hadronic state preparation and the evaluation of the real-time light-front correlators, to study parton distribution functions (PDFs). As a proof of concept, we demonstrate the first direct simulation of the PDFs in the 1+1 dimensional Nambu-Jona-Lasinio model. We show the results obtained by numerical diagonalization and by quantum computation using classical hardware. The agreement between these two distinct methods and the qualitative consistency with QCD PDFs validate the proposed quantum algorithm. Our work suggests the encouraging prospects of calculating QCD PDFs on current and near-term quantum devices. The presented quantum algorithm is expected to have many applications in high energy particle and nuclear physics.

For the second part, light-cone distribution amplitudes (LCDAs) are essential nonperturbative quantities for theoretical predictions of exclusive high-energy QCD processes. We demonstrate the prospect of calculating LCDAs on a quantum computer by applying a recently proposed quantum algorithm, with Staggered fermions, to the simulation of the LCDA in the 1+1 dimensional Nambu-Jona-Lasinio model on classical hardware. The agreement between the quantum simulation and the numerical diagonalization justifies the proposed quantum algorithm. In addition, we find that the resulting LCDA exhibits features shared with the LCDAs in QCD.

Parallel Session IV (2)：Hadron and Flavor Physics / 131

Studies of γγ-> γψ(2S) and e+e- ->ηϕ at Belle

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Using 980 fb-1 of data on and around the Y(nS)(n=1,2,3,4,5) resonances collected with the Belle detector at KEKB, the two-photon process γγ-> γψ(2S) is studied from √s = 3.7 GeV to 4.2 GeV for the first time. Two structures with resonance parameters being measured are seen in the invariant mass distribution of γψ(2S). And the cross section of e+e- ->ηϕ via initial-state radiation are measured from threshold to 3.95 GeV. The resonant parameters of ϕ(1680) and the branching fraction of ϕ(1680)⟶ηϕ are also measured in this work.

Parallel Session VII (1)：TeV and BSM Physics / 132

Testing the standard model and searching for new physics at the Future Collider

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The collider experiment is the most effective means in recent years to verify the standard model and find new physics. The discovery of the Higgs in 2012 by the Large Hadron Collider (LHC), currently operating at CERN, completed the final piece of the standard Model puzzle.
Measuring the longitudinal polarization of the vector boson scattering process is an important way to explore the Higgs mechanism and find new physics. However, in the LHC experiment, due to the low case yields, it may require extremely high brightness and advanced data analysis techniques to reach the required confidence threshold. Instead, the future collider may have more potential to do so. Therefore, we use monte Carlo method to study the sensitivity of TeV level muon collider to detect longitudially polarized ZZ scattering. We found that in order to achieve a confidence level of 5 standard deviations, we could do this with data at a luminosity of about 3000Fb ˆ(-1) at the Muon Collider with 14TeV collision energy.
In addition, the recent CDF experiment has given a result of measuring W boson mass that exceeds the standard deviation by 7 times of the standard model, which has attracted widespread attention. We propose a new neutrino-lepton collider to accurately measure the mass of the W boson. The results show that although achieving high instantaneous luminosity of the neutrino beam is a challenge, we only need to achieve a total luminosity of 0.1 Fb ˆ(-1) to achieve an accuracy level of 10MeV for the W boson mass.

Summary:

At a 14 TeV muon collider, a □□ discovery of longitudinal polarization can be achieved, with □=□□□□□□ˆ(−□).
At a [1000, 3] GeV neutrino positron collider, a 10 MeV accuracy on □_□ can be achieved, with □=□.□□□ˆ(−□).

Parallel Session IV (2)：Hadron and Flavor Physics / 133

Recent result of quarkonium from Belle and Belle2

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The Belle experiment at the KEKB energy-asymmetric e+-e- collider accumulated dataset with integrated luminosity of 1/ab, including Upsilon(nS) on resonances, off-resonances, and Upsilon(5S) scan data. And the Belle II experiment is a substantial upgrade of the B factory facility, with much higher instantaneous luminosity and will accumulate 50/ab of data. Belle II has already accumulated about 400/fb of dataset, as well as the Y(10750) scan data at four energy points with the luminosity of 19.22/fb. With these datasets, Belle and Belle II would be able to search for new states on charmonium, bottomonium, and baryons spectroscopies, and measure their properties. In this presentation, we will review the latest quarkonium results from Belle and Belle II.

Parallel Session III (3): Heavy Ion Physics / 134

Global constraint on the jet transport coefficient via jet quenching observables in heavy-ion collisions

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The suppression of large transverse momentum (p_{T}) hadrons and the yield of dihadrons and γ-hadrons in relativistic heavy-ion collisions is a direct consequence of the parton energy loss induced by parton-medium interactions, whose strength is described by the jet transport coefficient $\hat{q}$ of the quark-gluon plasma (QGP). Because dihadrons and γ-hadrons have different geometric bias than single-hadron suppression, they probe different regions of the QGP and are sensitive to $\hat{q}(T)$ in different temperature (T) regimes. We carry out the first global Bayesian constraint on the jet transport coefficient using a next-to-leading order pQCD parton model with higher-twist parton energy loss, combining experimental data of single-hadron, dihadron and γ-hadron suppression at both RHIC and LHC energies with a wide range of centralities.

Summary:

The combined global Bayesian analysis with the information field (IF) approach produces a stringent constraint on the jet transport coefficient $\hat{q}(T)$ with a strong temperature dependence. Especially, we demonstrate the progressive constraining power on the temperature depednence of $\hat{q}$ using data from different centralities, beam energies and discussed the advantage of using both inclusive and correlation observables. The results can describe the global data on the suppression of single inclusive, dihadron and γ-hadron spectra as well as the elliptic anisotropy v_2 of large p_{T} single inclusive hadrons.

Parallel Session IX (5)：Particle Detector Technology / 135

Fast Simulation and Design of Muon Scattering Tomography System

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Muon scattering tomography (MST) using cosmic ray muons of strong penetrating power as probes, is a non-destructive technique explored recently to image dense objects, such as nuclear materials. In this work, a toy Monte Carlo tool is developed to simulate multiple scattering process of muons and spatial resolution of tracking detectors in MST system efficiently. The trackers of the MST system are to be built with plastic scintillating fibers, of which the track angular resolution is obtained from Kalman Filter algorithm. The well-known point of closest approach (PoCA) is applied to evaluate imaging performance of the MST system for different materials. This fast full-chain simulation tool can contribute to explore the influence of detector spatial resolution and layout on imaging performance. To further improve MST identification ability on dense materials, a Cherenkov detector will be introduced to measure muon momentum in the near future.

Parallel Session IX (5)：Particle Detector Technology / 136

Gain Measurement of Silicon Photomultiplier

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Silicon photomultiplier (SiPM) is an emerging device in photon detection, which features insensitivity to external magnetic field, more compact size and relatively low-voltage operation compared with PMT. This opens up broad applications of SiPM in particle physics experiments, such as LHCb, DarkSide, JUNO-TAO, LHAASO and HERD. To evaluate the SiPM sensitivity on the level of a single photon, we construct test setups for its gain measurement at different bias voltages and operation temperatures in this work. Referring to the relation of SiPM gain to bias voltages and temperatures, a bias correction factor is analyzed to compensate SiPM gain at different temperatures.

Parallel Session VI (5)：Particle Detector Technology / 137

用于 CEPC 内层顶点探测器的高计数率 CMOS 像素探测器芯片研制

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高能环形正负电子对撞机（Circular Electron Positron Collider, CEPC）内层顶点探测器，对于重味夸克重建与分辨至关重要。为实现高精度的物理测量，对内层顶点探测器的物质量、空间分辨率、读出速度以及功耗等方面的性能提出了极严苛的要求。CMOS 像素探测器（CMOS Pixel Sensor, CPS）技术在上述各性能方面具有很大的优势，是很有前景的候选探测器技术之一。自 2015 年起，CEPC 顶点探测器研发团队开展了一系列的 CMOS 像素探测器芯片研发工作。根据最新的对撞机设计方案和电子束本底的研究结果，顶点探测器内层的最高击中率预计高达 ˜107/cm2/s。为满足 CEPC 顶点探测器的最高击中率需求，研发团队开展一款名为 TaichuPix 的 CMOS 像素探测器芯片的研发。采用 180 nm CMOS 工艺，目前已经完成了两个小规模原型芯片 (25 mm2) 的设计和验证，均能够满足高达 36 MHz/cm2 的击中率需求。本报告将介绍像素内读出电路的设计改进，以实现 25 μm 的像素间距和 40 MHz 的快速读出频率。像素阵列的读出基于一种改进型的“列级数据传输链”的读出结构，并设计了两种不同的像素数字读出电路作为对比方案。像素按照每两列一组排列，所有双列并行读出，以尽量减少死时间。列内有优先级编码器，在列末端有时间计数器以记录信号击中像素的时间戳。当其中一个像素检测到击中时，列末端电路以 25 ns 的时间分辨率存储当前时间戳。在触发模式下，击中的时间戳（时间窗口为 175 ns）与触发信号匹配的数据被存至芯片级存储器。数据可通过高速串行数据接口输出至芯片外。本报告将介绍两颗 TaichuPix 原型芯片的电学测试和放射源测试，以及电离辐射前后芯片功能和噪声、阈值性能的测试结果。

Parallel Session IX (5)：Particle Detector Technology / 138

高精度时钟与控制信号分发与同步技术研究进展

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高精度时钟分发与同步在大型物理实验中是必不可少的组成部分，它是精密时间测量以及多模块协同工作的前提。在国家自然科学基金委重大科研仪器研制专项——低温高密核物质探测谱仪（CEE）的研制中，时间测量要求达到最高约为 10 ps 的精度，这相较于目前稳定运行的大型物理实验中约 20 ps 的精度有明显提高，因此也就对时钟分发精度提出了极高的要求。本报告中将介绍基于级联架构的时钟分发系统以实现长距离、多节点、高精度的时钟分发与同步。此外，针对新一代加速器装置中特殊频点时钟分发以及自动相位补偿的挑战，本报告将介绍在兼容标准频点时钟分发的基础上，基于 Whiter Rabbit (WR) 结合 Direct Digital Frequency Synthesis (DDS) 方案实现高精度、长距离、特殊频率时钟信号分发并进行自动相位补偿的时钟系统设计。

Parallel Session III (3): Heavy Ion Physics / 139

A systematic study for the qualitative connection between hadrons and the quark components in the nuclear modification factor

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We propose a method qualitatively connecting the hadron nuclear modification factor to its quark component nuclear modification factor. We give a systematic study of the connection in the frame of the numerical Monte-Carlo model PACIAE. It turns out that the hadron nuclear modification factor is usually smaller than that of its quark component. The flavor (mass) ordering of the nuclear modification factor is also studied.

Parallel Session IV (5)：Particle Detector Technology / 140

R&D on thin-gap RPC towards production for ATLAS Phase-2 upgrade

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New type of Resistive Plate Chamber (RPC) will be installed in the ATLAS detector during the Phase-II Upgrade. Chinese cluster (USTC-SDU-SJTU) has made important contribution in producing, testing and improving this new type of RPC. To match the requirement of the upgrade, the width of RPC gas gaps reduced from 2 mm to 1 mm and faster Front-End Electronics were applied. Simultaneously, many R&D efforts have been performed by simulations together with experimental measurements. Towards the mass construction, the production technology and QC method will also be discussed in this talk.

Parallel Session IX (3)：Heavy Ion Physics / 141

Quantum kinetic theory and collisional contributions to shear induced polarization

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We derive a quantum kinetic theory for QED based on Kadanoff-Baym equation. It generalizes the well-known classical kinetic theory to the polarized case, with spin polarization entering in the next order of gradient expansion. We also discuss generalization to QCD. We use this framework to study shear induced polarization for Lambda hyperon in heavy ion collisions. We find new collisional contributions to shear induced polarization coming from self-energy and gauge link respectively. The new contributions are parametrically the same as the one considered so far in the literature. They can lead to modest suppression of the shear induced polarization in phenomenological studies.

Parallel Session V (3)：Heavy Ion Physics / 142

Criticality of QCD in correlated Dirac eigenvalues

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We present a first study on the correlated Dirac eigenvalues in the vicinity of the chiral phase transition of N_f=2+1 QCD. We analyze the quark mass and temperature dependences of the first and second order quark mass derivatives of Dirac eigenvalue spectrum, i.e. $\partial\rho/\partial m_l$ and $\partial^2\rho/\partial m_l^2$. This is done through the correlated Dirac eigenvalues based on a novel method 1. Simulations are performed at temperatures from about 137 MeV to 176 MeV on $N_\tau = 8$ lattices using the highly improved staggered quarks and the tree-level improved Symanzik gauge action.

The strange quark mass is fixed to its physical value $m_s^{\rm phy}$ and the light quark mass m_l is set to $m_s^{\rm phy}/20$, $m_s^{\rm phy}/27$, $m_s^{\rm phy}/40$, $m_s^{\rm phy}/80$ that correspond to the Goldstone pion masses $m_\pi \approx 160, 140, 110, 80$ MeV, respectively 2.

In sharp contrast to our findings at high temperature of $1.6\,T_c$ 1, ρ is no longer proportional to m_l^2 in the vicinity of the chiral phase transition. Instead, we observe that $\partial\rho/\partial m_l/\chi_{\rm disc}$ and $\partial^2\rho/\partial m_l^2/\chi_2$ are quark mass and temperature independent at $T \in [137, 153]$ MeV, where $\chi_{\rm disc}$ is the disconnected

chiral susceptibility and χ_2 is part of quark mass derivative of $\chi_{\rm disc}$ that is related to $\partial^2\rho/\partial m_l^2$. Based on this observation in the vicinity of the chiral phase transition temperature, we will discuss the connection between the criticality of chiral phase transition and Dirac eigenvalue spectrum as well as its quark mass derivatives.

References

1 H. T. Ding, S. T. Li, S. Mukherjee, A. Tomiya, X. D. Wang and Y. Zhang, Phys. Rev. Lett. 126, no.8, 082001 (2021) doi:10.1103/PhysRevLett.126.082001 [arXiv:2010.14836 [hep-lat]].

2 H. T. Ding, W. P. Huang, M. Lin, S. Mukherjee, P. Petreczky and Y. Zhang, PoS LATTICE2021, 591 (2022) doi:10.22323/1.396.0591 [arXiv:2112.00318 [hep-lat]].

Parallel Session V (1)：TeV and BSM Physics / 143

Projected three-point energy correlator at NNLL

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The energy correlators measure the pattern of the energy deposition in detectors. The collinear limit, where the angle between the detectors approaches zero, is of particular interest for describing the substructure of jets produced at colliders. By utilizing our factorization theorem and calculating the required ingredients, we perform the resummation of the logarithmically enhanced terms for the projected three-point energy correlator in the collinear limit through to NNLL by renormalization group evolution.

The ratio between the projected three-point energy correlator and the two-point energy correlator is an observable advantageous in extracting the strong coupling constant at colliders. We present the NNLL+NNLO perturbative result for this ratio, and consider the effects from power-suppressed non-perturbative QCD corrections. Such an observable with high accuracy may also probe non-trivial information of the jet-substructure and improve our understanding of QCD dynamics.

Parallel Session VII (2)：Hadron and Flavor Physics / 144

EicC 上核子结构及强子物理的研究

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中国极化电子-离子对撞机（EicC）项目是设想在将来建好的强流重离子加速器（HIAF）的基础上，进一步升级改造为电子-离子对撞机，为我国核物理和粒子物理以及相关科学领域提供大型综合实验平台。电子-离子对撞机，被称作当代卢瑟福散射实验，是人类认识物质世界深层次结构的理想工具。EicC 实验将聚焦在研究核子的内部结构，尤其是海夸克部分子的分布，以及原子核内部的核子短程关联以及原子核介质的强相互作用性质。此外，EicC 在研究研究重味奇特强子谱方面也具有独特的优势，这对于我们理解这些奇特强子态的性质具有极大的帮助。在本报告中，我将主要介绍 EicC 预研进展及在核子结构及强子物理方面的前景。

Parallel Session VII (2)：Hadron and Flavor Physics / 146

Experimental Program for Super Tau-Charm Facility

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The proposed STCF is a symmetric electron-positron beam collider designed to provide e+e− interactions at a centerof-mass energy from 2.0 to 7.0 GeV. The peaking luminosity is expected to be 0.5×10ˆ35 cm−2s−1. The energy region of STCF covers the pair production thresholds for tau-leptons, charmed meson & baryons, and all of the strange hyperons. STCF is expected to deliver more than 1 ab−1 of integrated luminosity per year. Huge samples of XYZ, Jpsi , D+, D+s and Lambdac decays could be used to make precision measurements of the properties of XYZ particles, search for new ones, and study their rare decays; map out the spectroscopies of QCD hybrids and glueballs; search for new sources of CP violation in the strange-hyperon and tau−lepton sectors with unprecedented sensitivity; make precise independent measurements of the Cabibbo angle (theta)c) to test the unitarity of the CKM flavor-mixing matrix and address the Cabibbo Angle Anomaly; search for anomalous decays with sensitivities extending down to the level of SM-model expectations; qualify Lattice QCD calculations; and provide precise inputs that are essential for the interpretation of results from other experiments.

Summary:

Parallel Session I (5)：Particle Detector Technology / 148

Design and Prototype Test of the Homogeneous Crystal Calorimeter for STCF

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The Super Tau-Charm Facility (STCF) is the next generation high luminosity e^+e^- collider concentrating on the tau-charm physics. STCF will reach a luminosity over $0.5 \times 10^{34} cm^{-2} s^{-1}$ at 4 GeV, which brings high event rate and high beam background to the detector system. The background count rate over 1 MHz per module places new demands on the electromagnetic calorimeter (EMC): maintaining good energy and position resolution under severe pileup condition. Meanwhile, the development of event timing and particle identification capability is also an important aspect of calorimeter R&D, where a time resolution of better than hundreds of picoseconds is expected.

In this talk, the simulation and optimization of the calorimeter system, the prototype manufacture and test results on the prototype are summarized. The STCF EMC is based on fast pure CsI crystal and read out by avalanche photodiodes (APD). By considering the effect of crystal and electronics response, as well as the pileup condition, a full chain of simulation and reconstruction is implemented into the Offline Software of Super Tau-Charm Facility (OSCAR). The architecture and module geometry of EMC are constructed by optimizing physics performance under OSCAR. Based on the module design, a novel wavelength shifter (WLS) enhanced prototype is manufactured, which highlights fast time response and good signal to noise ratio under a reasonable cost. The comprehensive test results on the prototype, especially on the radiation hardness of the prototype, the uniformity of light collection and the timing performance of the electronics, will also be presented.

Parallel Session III (5)：Particle Detector Technology / 149

塑料闪烁体反应堆中微子探测器

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Nuclear reactor safeguard, based on detection of electron antineutrino flux and energy spectrum, is of great interests to both administrative agencies such as International Atomic Energy Agency (IAEA) and neutrino community. A dominant reaction channel of such detection is inverse beta decay (IBD), for which discrimination of gamma against neutron is critical. In this study, pulse shape discrimination (PSD) is used over plastic scintillator, for its ease of detector assembly, no risk of leakage, and high chemical stability. Using 22Na and 137Cs radioactive sources to calibrate the energy response of the whole system (data acquisition and materials), EJ200 and EJ426 scintillator combination is used as the discrimination setup. The figure of merit (FOM) can reach 9.13 ± 0.01, and could be adopted to build a reactor neutrino safeguard detector. In addition, the PSD of two kinds of plastic scintillators were compared. The FOM of the EJ276 plastic scintillator can reach 1.35 ± 0.01 at the energy threshold of 1 MeV gamma equivalent in comparison to 0.96 ± 0.01 of UPS-113NG at the same energy threshold.

Summary:

In this study, a detector system composed of EJ200 and EJ426 plastic scintillators coupled with an XP3232 PMT was tested for thermal neutron and gamma discrimination. Gamma sources were used to perform energy calibration by fitting the Compton edges. The FOM value was calculated to be 6.61 ± 0.01 in the whole range of channels. Compared with the EJ276 or UPS-113NG plastic scintillator systems with fast neutron and gamma discriminating capability, the former has better discrimination power. Under the threshold of 1 MeV, the FOM of the EJ276 was 1.35 ± 0.01, and the UPS-113NG was 0.96 ± 0.01. Although the PSD power of EJ276 and UPS-113NG scintillator systems are weaker than that of EJ200 and EJ426 coupled, they have the advantage of compactness and less light loss. Therefore, all of them could be viable candidates for small safeguard detectors.

Parallel Session V (5)：Particle Detector Technology / 151

中子伽马多模探测器性能研究

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本文基于高速波形采样方法研究了 CLYC、CLLB、塑料闪烁体等中子伽马多模探测器的性能。使用 Cs137、Am-Be 中子源和加速器单能中子源测试了其用于中子伽马识别、热中子注量探测、快中子能谱探测以及伽马能谱探测方面的性能，并实现了对中子、伽马注量率和能谱的同时探测。结果表明在 0.1-10 MeV 范围内，CLYC 和 CLLB 均具有良好的线性并具有较好的能量分辨率，其中 CLYC 在 662 keV 的能量分辨率约为 4%。CLYC 探测器表现出了最优的综合性能，对于 Am-Be 中子源，CLYC 识别中子、伽马的优值因子（FOM）达到 2.5，对热中子的能量分辨率优于 4%。CLYC 探测器可通过 35Cl(n,p)35S 反应实现对快中子的探测，实验研究了 CLYC 在 1.4 - 5.2 MeV 单能中子入射时的响应，发现其具有良好的线性，可用于快中子的能谱探测，快中子峰的饱和因子（Quenching factor）为 0.9，并表现出了良好的中子伽马识别能力，FOM 值大于 1.3。而 CLLB 晶体和塑料闪烁体在快中子输入下的 FOM 值为 1.1 和 1.0，性能差于 CLYC 晶体。基于卷积神经网络方法，可实现对高计数率下复杂堆积信号类别的判断，结果表明神经网络算法对 n、g、n+g、n+n 脉冲的误判率小于 1%，对于 g+g 和 g+n 脉冲的误判率小于 3.6%，可给出远多于特征量算法的额外信息，具有较大的应用潜力和价值。

Summary:

低温超导探测器具有 eV 量级的能量分辨，同时该探测器同时具有无死层、吸收材料选型广泛、掺杂不敏感等特点，这也为实验测量带来了新的思路。本报告简要介绍国内该类探测器的发展现状，通过该探测器以铅 210 的能谱测量介绍该探测器在核素 4Pi 能谱测量方面的潜在应用。本报告最后分析它在中子衰变末态束缚态测量方面的应用可能性。

Parallel Session VI (2)：Hadron and Flavor Physics / 152

Lattice QCD using Large momentum effective theory

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I will talk about the lattice QCD progress of hadron structure using the Large momentum effective theory framework, especially the high accuracy calculation of the meson light-cone distribution amplitudes and investigation on the transverse momentum distributions.

Parallel Session III (2)：Hadron and Flavor Physics / 153

Factorization for weak annihilation B-meson decays

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We accomplish the analytical computation of the pure weak annihilation non-leptonic B-meson decay amplitudes at leading power in the heavy quark expansion. The novel observation regarding such fundamental hadronic quantities is that adding the missing hard-collinear contribution on top of the hard gluon exchange effect eliminates rapidity divergences entering the convolution integrals of factorization formulae.
Subsequently we identify the perturbative enhancement mechanism due to the penguin contractions of the current-current operators from the weak effective Hamiltonian,
which yields the significant impacts on the CP violating observables.

Parallel Session X(1)：TeV and BSM Physics / 155

CP properties measurement of the Higgs boson interaction with tau leptons with the ATLAS detector

作者： Antonio De Maria[1]

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This talk will present a measurement of the charge conjugation and parity (CP) properties in the Higgs boson interaction with τ leptons. The study is based on a measurement of CP-sensitive angular observables defined by the visible decay products of tau lepton decays, performed using a data sample corresponding to 139 ifb of proton–proton collisions recorded at a center-of-mass energy of $\sqrt{s}$= 13 TeV with the ATLAS detector at the Large Hadron Collider. The talk will outline the main part of the analysis, from the reconstruction of the CP-sensitive variables to the event selection and background estimation. The results are extracted from a profile likelihood fit using both signal sensitive regions as well as control regions for the main background processes. The results are compatible with the Standard Model predictions and the analysis is also able to exclude a pure CP-odd hypothesis at the level of 3.4 standard deviations.

Parallel Session X(1)：TeV and BSM Physics / 156

Search for scalar leptoquarks in the btautau final state with the ATLAS detector

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This talk will present a search for scalar leptoquarks in btautau final state using a data sample corresponding to 139 ifb of proton–proton collisions recorded at a center-of-mass energy of $\sqrt{s}$= 13 TeV with the ATLAS detector at the Large Hadron Collider. The signal benchmark model considered is a scalar leptoquark with an electric charge of 4/3e and quantum numbers 3B + L = -2, which decays exclusively into a b-quark and a tau-lepton. The talk will outline the main part of the analysis, from the event selection to the background estimation and the result extraction through a fit performed on the signal regions.
No significant excess above the Standard Model prediction is observed in the explored leptoquark mass range (0.4-2.5 TeV), and 95% confidence-level upper limits are set on the production cross-section times branching fraction of leptoquarks decaying to b-tau. Based on the analysis results leptoquark masses below 1.26˜TeV, 1.30˜TeV and 1.41˜TeV are excluded for a scalar leptoquark Yukawa coupling to b-quark and tau-lepton of 1.0, 1.7 and 2.5, respectively.

Parallel Session VIII (5)：Particle Detector Technology / 157

BEPCII 本底研究实验

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北京正负电子电子对撞机重大改造工程（BEPCII）已经稳定运行了 10 余年。面对未来高亮度的运行需求，束流本底问题的重要性愈发凸显。为了更好的理解 BEPCII 的本底影响，在 2021、2022 两年度的对撞-同步辐射转换间隙的机器研究时间，均进行了针对 BEPCII 的本底实验，围绕单束流本底和挡块影响开展了研究，结合实验条件开展了模拟工作。同时，2022 年度的实验，还围绕引入活动挡块后挡块附近隧道内的剂量率变化开展了实验。模拟和实验的研究结果均表明，单束流本底中托歇克本底占主导地位。模拟、实验的对比也表明，当前模拟工具同实验结果具有一定程度上的一致性，可依托当前工具开展未来装置的本底研究工作。初步实验结果也表明，当前 BEPCII 对撞点附近的活动挡块的启用会导致单束流探测器本底的增加，提示我们在设计挡块时，不仅需要考虑挡块理论上对一次本底的吸收作用，也必须考虑束流丢失粒子同挡块的相互作用及其带来的净效应，必要时考虑多重挡块设计，以更好的吸收丢失例子，达到抑制本底的设计效果。

Parallel Session VII (5)：Particle Detector Technology / 158

The 3-inch PMT system in JUNO experiment

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Jiangmen Underground Neutrino Observatory (JUNO) is the next generation of neutrino experiment in China to determine the neutrino mass ordering, which is under construction in Guangdong Province. The 25600 3-inch PMTs will be installed in the gaps between 17612 closely packed 20-inch PMTs to reach an excellent energy resolution [3%/√E(MeV)] and an accurate energy scale determination [better than1%]. The 3-inch PMT system not only can detect the IBD signals independently but also can measure the solar parameters θ12 and Δm212 independently. Besides, it also has the potential to improve measurements of supernova neutrinos and proton decay.
All 3-inch PMTs have been produced by the Hainan Zhanchuang Photonics Technology Co., Ltd (HZC) and were all instrumented with water proofing also in HZC. The acceptance tests almost finished in Guangxi University. Components of readout electronics were partially produced and are expected to finish in the next few months. The electronics assembling and integration testing are underway on JUNO surface ground site. The 3-inch PMTs and underwater boxes will begin to be installed on the JUNO detector after several months.

Parallel Session VII (5)：Particle Detector Technology / 159

Development of silicon interposer: towards an ultralow radioactivity background photodetector system

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It is of great importance to develop a photodetector system with an ultralow radioactivity background in rare event searches. Silicon photomultipliers (SiPMs) and application-specific integrated circuits (ASICs) are two ideal candidates for low background photosensors and readout electronics, respectively, because they are mainly composed of silicon, which can achieve good radio-purity without considerable extra effort. However, interposers, used to provide mechanical support and signal routes between the photosensor and the electronics, are a bottleneck in building ultralow background photodetectors. Silicon and quartz are two candidates to construct the low background interposer because of their good radio-purity; nevertheless, it is non-trivial to produce through silicon vias (TSV) or through quartz vias (TQV) on the large area silicon or quartz wafer. In this work, based on double-sided TSV interconnect technology, we developed the first prototype of a silicon interposer with a size of 10 cm×10 cm and a thickness of 320 μm. The electrical properties of the interposer are carefully evaluated at room temperature, and its performance is also examined at -110 °C with an integrated SiPM on the interposer. The testing results reveal quite promising performance of the prototype, and the single photoelectron signals can be clearly observed from the SiPM. The features of the observed signals are comparable with those from the SiPM mounted on a normal FR4-based PCB. Based on the success of the silicon interposer prototype, we started the follow-up studies that aimed to further improve the performance and yield of the silicon interposer, and eventually to provide a solution for building an ultralow background photodetector system.

Parallel Session III (2)：Hadron and Flavor Physics / 161

Search for invisible decays and rare decays at BESIII

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BESIII has collected 2.5 B $\psi(2S)$ events and 10 B J/ψ events. The huge data sample provide an excellent chance to search for new physics in charmonium decays. We report the search for the decay $J/\psi \to \gamma + invisible$ and a potential light Higgs A0 in radiative J/psi decay. We also search for the J/psi rare weak decay to $D^- e^+ \nu_e + c.c.$, and present the most stringent constraints of 10^{-6} at 90\% confidence level. The huge J/psi data set also produce lots of hyperon events at BESIII, which allow us to search for the rare decay of hyperon, such as the invisible decay of Lambda, \Xi semi-leptonic decay. The FCNC process for D0->pi0 vv is also search with the near threshold D0 events at BESIII.

Parallel Session III (2)：Hadron and Flavor Physics / 162

(Semi-)leptonic D decays at BESIII

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BESIII has collected 2.93 and 6.32 fbˆ-1 of e+e- collision data samples at 3.773 and 4.178-4.226 GeV, respectively. We will report precision measurements of fDs, |Vcs| and test of lepton flavor universality by studying the leptonic decays of Ds -> l+nu with tau+ -> rho+nu, pi+nu, and e+nunu. We will also report the studies of Ds -> pi0pi0e+nu and KSKSe+nu, inclusive Ds semileptonic decay, updates of D-> Ke nu with a new method.

Parallel Session III (2)：Hadron and Flavor Physics / 163

Hadronic charm hadron decays at BESIII

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BESIII has collected 2.93 and 6.32 fbˆ-1 of e+e- collision data samples at 3.773 and 4.178-4.226 GeV, respectively. We will report the observation of a new a0 resonance and amplitude analyses of Ds -> KSK+pi0, KSKSpi+, pi+pi0eta', KK3pi, Kpipipi0, and pi+pi0pi0. We will also report the transverse polarization determination in D0 -> omega phi, the KS/KL asymmetry studies in D0 -> KLX (X=eta, eta', omega and phi), observation of the new decay mode Dˆ*0 to Dˆ0 eˆ+eˆ-, and the measurements of the branching fractions of some D0(+) CF and DCS decays will also presented. In addition, BESIII has collected 4.5 fbˆ-1 of e+e- collision data between 4.6000 and 4.6999 GeV. This unique data offers ideal opportunity to determine absolute branching fractions of Lambda_c+ decays. We will report the first observation of Lambda_c+ -> npi+.

Parallel Session VIII (2)：Hadron and Flavor Physics / 164

R value measurements at BESIII

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At BESIII, the R value is measured with a total of 14 data points with the corresponding c.m. energy going from 2.2324 to 3.6710 GeV. The statistical uncertainty of the measured R is less than 0.6%. Two different simulation models, the LUARLW and a new Hybrid generated, are used and give consistent detection efficiencies and initial-state-radiation corrections. An accuracy of better than 2.6% below 3.1 GeV and 3.0% above is achieved in the R values.

Parallel Session V (2)：Hadron and Flavor Physics / 166

Recent results of Baryon electromagnetic form factors at BESIII

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At BESIII, the electromagnetic form factors (EMFFs) and the pair production cross sections of various baryons have been studied. The proton EMFF ratio |GE/GM| is determined precisely and line-shape of |GE| is obtained for the first time. The recent results of neutron EMFFs at BESIII show great improvement comparing with previous experiments. Cross sections of various baryon pairs (Lambda, Sigma, Xi, Lambdac) are studied from their thresholds. Anomalous enhancement behavior on the Lambda and Lambdac pair are observed.

Parallel Session V (2)：Hadron and Flavor Physics / 170

Hyperon physics at BESIII

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With the large datasets on □+□−-annihilation at the □/□ and □(3686) resonances collected at the BESIII experiment, multi-dimensional analyses making use of polarization and entanglement can shed new light on the production and decay properties hyperon-antihyperon pairs. In a series of recent studies performed at BESIII, significant transverse polarization of the (anti)hyperons has been observed in □/□ or □(3686) to ΛΛ‾ , ΣΣ‾ , ΞΞ‾, and Ω - anti- Ω + and the spin of Ω− has been determined model independently for the first time. The decay parameters for the most common hadronic weak decay modes were measured, and due to the non-zero polarization, the parameters of hyperon and antihyperon decays could be determined independently of each other for the first time. Comparing the hyperon and antihyperon decay parameters yields precise tests of direct, Δ□ = 1 CP-violation that complement studies performed in the kaon sector.

Parallel Session VIII (2)：Hadron and Flavor Physics / 172

Light Meson Spectroscopy at BESIII

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BESIII has the world’s largest samples of J/ψ and ψ(3686) events from ⊠+⊠—annihilations, which offer an ideal and clean laboratory to study light meson spectroscopy , in particular for the search for QCD exotics. Recent important achievements in this field, including the observation of a 1-+ state, eta1(1855) in J/psi->gamma eta eta’, the observation of the X(2600) in J/psi->gamma eta’ pi+pi-, and the PWA of J/psi->gamma eta’ eta’ will be highlighted.

Parallel Session VII (5)：Particle Detector Technology / 173

ATLAS High granularity timing detector activity at IHEP

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This talk summarized the activity of IHEP/NJU group on ATLAS High granularity timing detector (HGTD) in phase II upgrade. Low-Gain Avalanche Detector (LGAD) is one of the key technology for timing detector. IHEP developed radiation hard LGAD sensors with domestic technology (IHEP-IME sensor), which became the most radiation hard LGAD sensor by far. IHEP is also leading the HGTD module prototyping and module production. IHEP site is the largest production site in HGTD project, and is responsible for more than 1/3 of module production. IHEP/NJU are also responsible for Peripheral Electronics Boards (PEB) design and production. The development of PEB is one of the most challenging tasks in HGTD project.

Parallel Session VII (2)：Hadron and Flavor Physics / 174

The production of the molecules in high energy collisions

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In the last two decades, many of the resonances observed in high energy collisions are incompatible with the traditional quark model, and those resonances are called the exotic states.
We depict those exotic states as the hadron-hadron molecule states and estimate the cross section for the production of the molecules in high energy collisions.
We predict a ground-state D^+D^- hadronic atom $A_{D^+D^-}$, called dionium with quantum numbers $J^{PC} = 0^{++}$, and estimate the cross section for the inclusive prompt production of the dionium at CMS and LHCb and the direct production $p\bar{p} \to A_{D^+D^-}$ at PANDA. We expect that $calO(10^3 \sim 10^5)$ events can be collected in the reaction $p\bar{p} \to A_{D^+D^-} \to K^-\pi^+K^+\pi^-$ at PANDA.

Besides, we also predict the inclusive production of the double charm meson-meson, hidden charm meson-baryon, and hidden charm baryon-antibaryon molecules in ep collisions. In particular, we estimate the cross section for the production of the $\Xi_c\bar{D}^{(*)}$ and $\Lambda_c\bar{\Lambda}_c$ molecules are at $calO(100)$ pb in the Electron-Ion Collision (EIC), while that of cross sections are at $calO(1)$ pb for the Electron-ion collision in China (EicC). The cross sections for the production of P_c states are at $calO(0.1)$ pb at CEBAF 24 GeV.

Parallel Session II (5)：Particle Detector Technology / 176

The Upstream Tracker at LHCb

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The Upstream Tracker is a key component of the upgraded LHCb detector. Based on silicon strip sensors, the UT will ensure efficient and high-speed track reconstruction. The design and installation progress of the UT detector will be introduced.

Parallel Session IX (5)：Particle Detector Technology / 177

Plan for an upgrade Upstream Tracker at LHCb Upgrade II

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To fully exploit the flavour physics potential of High Luminosity LHC, the LHCb detector envisages another major upgrade around 2032 to increase the instantaneous luminosity to 1.5e34 cm-2s-1. The challenge on the silicon-strip based Upstream Tracker has been studied using simulation, and a replacement using silicon pixel detector is proposed. The new system design concept and potential technincal choices will be introduced.

Summary:

Parallel Session IX (5)：Particle Detector Technology / 178

Study of the Single-Event Effect on the SALT chip

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The Silicon ASIC for LHCb Tracker (SALT) chip is a dedicated frontend ASIC for silicon strip tracker developed for the LHCb Upstream Tracker. Its radiation tolerance against Single-Event Upset has been studied using proton beams at CIAE and CSNS. The experimental setup and preliminary results will be reported.

Summary:

Parallel Session IX (5)：Particle Detector Technology / 179

Development of HVCMOS-based silicon tracker for CEPC

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The CEPC physics programs unanimously rely on a high-resolution and low-material tracking system with a large-area coverage. The High Voltage CMOS (HVCMOS) technology is a promising candidate. Latest development based on ATLASPix3 sensor prototypes will be reported, including efforts to characterising the sensor performance in beamtest using electron beam at DESY.

Summary:

Parallel Session V (5)：Particle Detector Technology / 180

Next-Generation Scintillation Materials: Low-Dimensional All-Inorganic Cu(I) Halides

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Halide perovskites have become leading candidates for high-performance optoelectronic devices and radiation detectors. Currently more widely adopted method for radiation detection is using scintillators, which convert the ionizing radiation into UV/VIS/NIR light. Recent studies have shown the great potential of low-dimensional all-inorganic halide perovskites as high-performance scintillators thanks to the nature their intense self-trapped exciton emission. In this work, we report a set of ultrabright and highly efficient one-dimensional (1D) and zero-dimensional (0D) perovskite-like halide scintillators in the form of single crystals and thin films, such as Cs3Cu2I5, In+/Tl+ doped Cs3Cu2I5, CsCu2I3, and Cs5Cu3Cl6I2, for X-ray imaging and gamma spectroscopy applications. They show simultaneously high effective atomic number (Zeff), non-hygroscopic, self-absorption free, low afterglow, high scintillation yield, and excellent energy resolution characteristics which is a unique feature among scintillation materials. Thus, they can serve as versatile scintillators covering a wide range of radiation energies for various applications incl. high-energy physics, homeland security and medical imaging.

Summary:

I. INTRODUCTION

Recently, low dimensional perovskite-like metal halides for light emitting and scintillation applications have drawn tremendous attention due to their extremely high photoluminescence quantum yields (PLQYs) and large Stokes shift, among which ternary copper(I) halides are the most studied ones because of their excellent photophysical properties and decent stability. For instance, Tang reported the ultrahigh LY (˜90,000 photons/MeV) of Rb2CuBr3 scintillators with an emission peak at 385 nm 1. Other copper halide scintillators have also been investigated, such as Rb2CuCl3, Cs3Cu2Cl5 and (TBA)CuX2 (TBA = tetrabutylammonium cation; X = Cl, Br) in the forms of single or poly-crystals. However, one serious shortage for Rb2CuBr3 scintillator is that the Rb element shows high natural radioactivity, which may hinder its practical application in scintillator materials.

This work reports a series of high-performance cesium copper(I) halide scintillators with strong self-trapping exciton (STE) emissions, such as Cs3Cu2I5, CsCu2I3, and Cs5Cu3Cl6I2 [2-4]. They show simultaneously high effective atomic number (Zeff), non-hygroscopic, self-absorption free, low afterglow, high scintillation yield, and excellent energy resolution characteristics which is absolutely unique feature among scintillation materials. Moreover, after doping with Tl+ and In+, the X-ray and gamma-ray detection performance of Cs3Cu2I5 was further improved thanks to the enhanced harvesting of charge carriers (and excitons) [5,6].

II. RESULTS AND DISCUSSION

Low-dimensional perovskite-like halide single crystals Cs3Cu2I5, CsCu2I3, and Cs5Cu3Cl6I2 with a diameter of 7 mm were grown by the Bridgman method. The thin films of these compounds were prepared via the vapor deposition method. All of them have high Zeff, no hygroscopicity, and low melting point. Their crystal structure belongs to the orthogonal crystal system with the dipole-allowed direct bandgap of 3.5˜3.7 eV. The valence band maxima are composed of the Cu 3d orbitals and the conduction band minima are composed of the Cu 4s. The halogen p orbitals also contribute to the valence and conduction bands.

Cs3Cu2I5 single crystal has an orthorhombic crystal structure, Pnma space group and 0D electron structure. The density and Zeff are 4.51 g/cm3 and 52.2, respectively. Its intense STE emission centered at 445 nm shows a large Stokes shift of 1.35 eV, which excludes self-absorption. Its scintillation yield is 32 000 photons/MeV with an ultra-low afterglow of 0.03% at 10 ms under X-ray radiation. Cs3Cu2I5 also has excellent energy resolution of 3.4±0.2% at 662 keV, high light yield of 29,000 photons/MeV, and a principal decay time of 967 ns under 137Cs γ-ray radiation. After doping Tl+ into the lattice, The PLQY of Cs3Cu2I5:Tl crystal was further increased from 70% to 80%. A very low X-ray detection limit (66.3 nGyair/s) of Cs3Cu2I5:Tl single crystal is only 1/83 of the medical X-ray diagnostic requirements. Extremely low X-ray afterglow of only 0.17% at 10 ms is one order of magnitude lower than commercial CsI:Tl crystals. Cs3Cu2I5:Tl crystal also has excellent γ-ray detection capability, with a light yield of up to 87,000 photons/MeV and an energy resolution of 3.4% at 662 keV.

1D CsCu2I3 is composed of Cs+ and [CuI4]n3n- tetrahedral chains. It has a high density of 5.01 g/cm3 and a high Zeff of 50.6. Its STE emission peaks at 570 nm and has a large Stokes shift of 1.54 eV. Its scintillation yield is 16,000 photons/MeV with a principal decay time of 97 ns. It is very worth noting that it has an extremely low afterglow level of 0.008% at 10 ms, which is three orders of magnitude lower than that of commercial CsI:Tl scintillator.

The crystal structure of Cs5Cu3Cl6I2 can be described as 1D zigzag [Cu3Cl6I2]n5n– chains separated by Cs+ cations. The 1D chains of [Cu3Cl6I2]n5n– consists of connected [CuCl2I]24- units and single [CuCl2I2]3- units. Due to the strong exciton-phonon coupling, Cs5Cu3Cl6I2 emits bright cyan light (475 nm) associated with STE emission with a large Stokes shift of 1.2 eV. High crystal quality and large exciton binding energy of 1 eV render a high PLQY of 70% for Cs5Cu3Cl6I2. The scintillation yield of Cs5Cu3Cl6I2 can reach 87,000 photons/MeV, which is one of the highest value ever reported for self-activated scintillators.

III. CONCLUSIONS

We developed a serious of bright and sensitive low-dimensional perovskite-like Cu(I) halide scintillators and demonstrated their excellent X-ray imaging and gamma spectroscopy capability. They show the desirable and rare combination of high Zeff, non-hygroscopic, self-absorption free, high scintillation yield, and excellent detection limit characteristics which are unique among scintillation materials. Moreover, cheap raw materials, low temperature melting point, and possibility to scale-up the crystal size in industrial manufacturing will result in very competitive pricing which is critically important for applications. Thus, the low-dimensional Cu(I) halides could be regarded as next-generation scintillation materials.

REFERENCES

1 B. Yang, L. Yin, G. Niu, J.-H. Yuan, K.-H. Xue, Z. Tan, X.-S. Miao, M. Niu, X. Du, H. Song, E. Lifshitz, and J. Tang, "Lead-Free Halide Rb2CuBr3 as Sensitive X-Ray Scintillator," Advanced Materials, vol. 31, no. 44, pp. e1904711, Nov, 2019.

2 S. Cheng, A. Beitlerova, R. Kucerkova, M. Nikl, G. Ren, and Y. Wu, "Zero-Dimensional Cs3Cu2I5 Perovskite Single Crystal as Sensitive X-Ray and γ-Ray Scintillator," physica status solidi (RRL) –Rapid Research Letters, vol. 14, no. 11, pp. 2000374, 2020.

3 Q. Wang, M. Nikl, S. Cheng, G. Ren, Y. Wu, "Undoped and Tl-doped Cs3Cu2I5 thin film as potential X-ray scintillators," physica status solidi (RRL) –Rapid Research Letters, vol.15, pp. 2100422, 2021.

[4] S. Cheng, A. Beitlerova, R. Kucerkova, E. Mihokova, M. Nikl, Z. Zhou, G. Ren, and Y. Wu, "Non-Hygroscopic, Self-Absorption Free, and Efficient 1D CsCu2I3 Perovskite Single Crystal for Radiation Detection," ACS Appl Mater Interfaces, vol. 13, no. 10, pp. 12198-12202, Mar 17, 2021.

[5] S. Cheng, M. Nikl, A. Beitlerova, R. Kucerkova, X. Du, G. Niu, Y. Jia, J. Tang, G. Ren, and Y. Wu, "Ultrabright and Highly Efficient All-Inorganic Zero-Dimensional Perovskite Scintillators," Advanced Optical Materials, vol. 9, no. 13, 2021.

[6] Q. Wang, Q. Zhou, M. Nikl, J. Xiao, A. Beitlerova, S. Cheng, X. Wen, J. Wang, G. Niu, J. Tang, G. Ren, Y. Wu, "Highly resolved X-ray imaging enabled by In(I) doped perovskite-like Cs3Cu2I5 single crystal scintillator," Advanced Optical Materials DOI:10.1002/adom.202200304.

Parallel Session III (1)：TeV and BSM Physics / 182

Measuring CP properties of Higgs boson interactions with τ leptons with the ATLAS detector

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This poster will present a measurement of the charge conjugation and parity (CP) properties in the Higgs boson interaction with τ leptons. The Yukawa interaction is generalized with a single mixing angle parameter ϕ_τ to describe CP-odd interactions between the Higgs boson and τ leptons. The study is based on a measurement of CP-sensitive angular observables defined by the visible decay products of τ lepton decays, performed using a data sample corresponding to 139 fb^{-1} of proton–proton collisions recorded at a center-of-mass energy of $\sqrt{s}$= 13 TeV with the ATLAS detector at the Large Hadron Collider.
Without assuming Standard Model hypothesis for the $H \to \tau\tau$ signal strength,
the mixing angle ϕ_τ is measured to be $9 \pm 16°$, with an expected value of $0 \pm 28°$ at the 68\% confidence level.
The pure CP-odd hypothesis is disfavoured at 3.4 standard deviations.
The results are compatible with the predictions for the Higgs boson in the Standard Model as well as CP-violating scenarios.

Parallel Session III (5)：Particle Detector Technology / 183

低温超导探测器在低能粒子探测方面的应用探索

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低温超导探测器基于热信号实现对粒子的能量测量，具有 eV 量级的能量分辨，相较于传统的半导体探测器，其能量分辨提高了一到两个量级，因此对能量分辨要求高的测量场景十分有利。该探测器同时具有无死层、吸收材料选型广泛、掺杂不敏感等特点，这也为实验测量带来了新的思路。本报告简要介绍国内该类探测器的发展现状，之后通过该探测器以铅 210 的能谱测量为例介绍该探测器在核素 4Pi 能谱测量方面的潜在应用。本报告最后针对该探测器特点，分析它在中子衰变末态束缚态测量方面的应用可能性。

Summary:

Parallel Session IV (2)：Hadron and Flavor Physics / 184

Color-octet contributions for J/ψ inclusive production at B factories in soft gluon factorization

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We have studied color-octet contributions for J/ψ inclusive production at B factories, i.e., $e^+e^- \to J/\psi(^3P_J^{[8]}, ^1S_0^{[8]}) + X_{\mathrm{non}-c\bar{c}}$, using the soft gluon factorization (SGF) approach, in which the J/ψ energy spectrum is expressed in a form of perturbatively calculable short-distance hard parts convoluted with one-dimensional soft gluon distributions (SGDs). The series of velocity corrections originated from kinematic effect can be naturally resummed in this approach. Short-distance hard parts have been calculated analytically to next-to-leading order in α_s. Renormalization group equations for SGDs have been derived and solved, which resums Sudakov logarithms originated from soft gluon emissions. Our final result gives a upper bound for color-octet matrix elements consistent with that extracted from hadron colliders. This may relieve the well-known universality problem in the NRQCD factorization.

As a comparison, we also analytically calculated short-distance hard parts in the NRQCD factorization, with Sudakov logarithms resummed by using soft collinear effective theory. The comparison shows that velocity corrections from kinematic effect, which have been resummed in SGF, are significant for phenomenological study. Furthermore, it is found that Sudakov logarithms originated from soft gluon emissions are very important, while it is not the case for Sudakov logarithms originated from jet function. Therefore, the partial Sudakov resummation in SGF has already captured the main physics.

Parallel Session I (5)：Particle Detector Technology / 185

中国散裂中子源探测器研制进展

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中国散裂中子源（CSNS）是“十二五”期间重点建设的大科学装置，是国际前沿的高科技、多学科应用的大型科研基础设施。探测器作为中子谱仪最昂贵的核心设备之一，长期以来严重依赖进口，并受制于发达国家的技术封锁，已成为制约我国中子谱仪建设与运行的“卡脖子”问题。依托大科学工程 CSNS 建设，围绕中子谱仪的紧迫需求，通过对探测器、电子学、数据获取和实时控制等全技术链条的长期系统研究，解决了探测器多项共性的关键技术，建立了工程化大规模应用的探测器体系，积累了大量的探测器研发和运行的经验，培养了一支专业的、年轻化的先进中子探测器装备研制队伍。团队先后完成了 CSNS 多台中子谱仪（通用粉末谱仪、小角中子散射谱仪、多功能反射谱仪、多物理谱仪、应力谱仪）探测器和中子束流监测器的研制任务，为每一种探测器专门开发了读出电子学和数据获取系统，实现了大面积闪烁体探测器 (几十平米)，大面积 3He 管阵列探测器 (几十平米)，高分辨成像探测器以及高通量二维 GEM 中子探测器的大规模工程应用。2018 年 8 月通过了国家验收，所有技术指标均达到了中子谱仪应用需求，目前已稳定高效运行 5 年，支撑完成了 600 余项研究课题实验。下一阶段将继续完善中子谱仪探测器研发体系，在已经掌握的中子探测器技术基础上，向着更大面积、更高空间分辨、更高探测效率以及更高集成度四方向发展，为国内多个中子源提供自主研发的先进中子探测器，促进我国中子科学与技术蓬勃发展。

Parallel Session VII (2)：Hadron and Flavor Physics / 186

Inclusive and semi-inclusive production of spin-3/2 hadrons in e+e− annihilation

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We investigate the inclusive and semi-inclusive productions of spin-3/2 hadrons, such as Ω, in unpolarized e^+e^- annihilation. We derive a complete definition of quark transverse momentum dependent (TMD) fragmentation functions (FFs) to spin-3/2 hadrons for the first time from the decomposition of the quark-quark correlation matrix at leading twist, 14 of which are newly defined corresponding to rank-3 tensor polarized hadron. The collinear FFs are obtained by integrating over quark transverse momentum, and only two TMD FFs with rank-3 tensor polarization have nonvanishing collinear counter parts. Then we perform a leading order calculation of the unpolarized differential cross sections. In the single-hadron inclusive production, only two structure functions are found nonzero and none of the rank-3 tensor polarized FFs contributes. For the nearly back-to-back two-hadron production, half of the 48 structure functions are found nonzero even if the spin of the second hadron is not analyzed, and ten of the rank-3 tensor polarized TMD FFs contribute. Therefore, one can study the rank-3 tensor polarized FFs via the production of a spin-3/2 hadron and an unpolarized hadron in unpolarized e^+e^- collision experiments. These newly defined FFs can be further applied in semi-inclusive deep inelastic scattering processes for the study of nucleon structures.

Parallel Session IX (5)：Particle Detector Technology / 187

A Novel Reconstruction Method for Atmospheric Neutrinos in Large Liquid Scintillator Detectors with Machine Learning Technique

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Large liquid scintillator detectors such as JUNO play an important role in particle physics. They typically provide low-threshold, high-precision energy measurements, but their ability in getting other event informations, especially the particle direction, is limited with traditional reconstruction methods. These informations are critical to atmospheric neutrino oscillation analysis, which offers independent sensitivity to neutrino mass ordering for JUNO. In this talk we present a novel method for the reconstruction of atmospheric neutrino events in JUNO and other large liquid scintillator detectors, by extracting features from PMT waveforms and use them as inputs to machine learning models. This method is able to reconstruct multiple objects, including direction, energy, interaction vertex, event type, etc., and has the potential to achieve better resolution than traditional methods. The performance of this method using JUNO simulation will be presented.

Parallel Session I (2)：Hadron and Flavor Physics / 189

Lattice calculation of the $\eta_c\eta_c$ and $J/\psi J/\psi$ scattering length

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We calculate the s-wave scattering length in the 0^+ sector of $\eta_c\eta_c$ and the 2^+ sector of $J/\psi J/\psi$ using three $N_f = 2$ twisted mass gauge ensembles
with the lattice spacing $a = 0.0667, 0.085, 0.098$ fm, respectively.

The scattering lengths are extracted using the conventional L{\"u}scher finite size method. We observe significant discretization effects and therefore perform a continuum extrapolation. Finally, we obtain the results as $a^{0^+}_{\eta_c\eta_c} = -0.104(09)$ fm and $a^{2^+}_{J/\psi J/\psi} = -0.165(16)$ fm, where the errors are statistical errors with the uncertainties of lattice spacing taken into account. Both scattering lengths are negative, indicating that the interaction between the two charmonia are repulsive in nature in both channels being studied.

Parallel Session IV (5)：Particle Detector Technology / 190

大面积陶瓷 GEM 中子探测器研究

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新一代强流质子脉冲中子源的出现为中子散射技术的研究提供了高通量中子束流，同时对中子谱仪探测器的综合性能提出了新的挑战。依托于中国散裂中子源 (CSNS)，研究用于中子散射实验的大面积、高效率和高计数率的位置灵敏型陶瓷 GEM 中子探测器，攻克大面积陶瓷 GEM 膜制作、大面积涂硼技术和快速读出电子学等 3 大关键技术，打破国外技术封锁实现核心器件国产化，为今后国内中子散射装置提供具有完全自主知识产权的大面积国产中子探测器奠定基础。探测器原型机已成功应用于中子束流实验，实现有效面积 ~300mm×300mm，位置分辨 (FWHM) ~ 3mm，最高计数率 ~ 1MHz 等性能。

Parallel Session II (5)：Particle Detector Technology / 193

The ATLAS Inner Tracker Strip Detector System

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The Upgrade of the Large Hadron Collider to the High Luminosity LHC (HL-LHC) is scheduled to start around 2028 and will result in the delivery of ten times more integrated luminosity to the experiments. To withstand the much harsher radiation and occupancy conditions of the HL-LHC, the inner tracker of the ATLAS detector must be redesigned and rebuilt completely. The design of the ATLAS Upgrade inner tracker (ITk) has already been defined. It consists of several layers of silicon particle detectors. The innermost layers will be composed of silicon pixel sensors, and the outer layers will consist of silicon microstrip sensors. This talk will focus on the latest research and development activities performed by the China ITk strips group with respect to the assembly and test of the strip modules towards the on-going site qualifications.

Parallel Session IX (5)：Particle Detector Technology / 194

Quality Assurance for the ATLAS Inner Tracker strip sensor

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In order to mornitor nearly 22,000 large area silicon strip sensors production for the ATLAS Inner Tracker, a Quality Assurance (QA) strategy has been prepared to be carried out during the whole production period. A detailed irradiatioin and testing plan has been prepared. The programe with the Mini sensors focusing on the target fluence 1.6e15 neq/cm2 utilizing the Associated Proton Experiment Platform (APEP) in China Spallation Neutron Source (CSNS) and the study of Charge Collection Efficiency (CCE) as a function of reverse bias voltage using the AliBaVa LHC-speed analogue Beetle ASIC read-out system will be presented.

Parallel Session IX (5)：Particle Detector Technology / 195

碳化硅高时间分辨探测器

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粒子物理高能量质子-质子对撞、核物理电子-离子对撞等科学前沿，以及在建的高能质子束线等大科学装置急需具有抗辐照能力强、时间分辨能力高的半导体粒子探测器。碳化硅作为第三代宽禁带半导体材料，具有更大禁带宽度、更高位移阈能和更高击穿场强等显著优势，成为高温抗辐照粒子探测器研究领域的前沿热点。本报告将针对已有的 4H-SiC 器件的快时间响应（94ps）进行介绍，并对未来的 3D-SiC 器件经过自主开发软件 RASER 研究可以达到 25ps 的响应速度进行展望。

Parallel Session IX (5)：Particle Detector Technology / 196

应用于能量分辨中子成像的探测器研制

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随着中子源技术及成像方法学的快速发展，将高空间分辨和能量分辨中子成像，特别是与布拉格边中子成像结合起来，同时测量材料内部的形貌特征、残余应力和织构，已成为中子成像技术未来发展的趋势。依托中国散裂中子源，结合飞行时间方法，基于快时间分辨相机和像增强器，研制了可应用于能量分辨中子成像的探测器。在散裂中子源测试束线开展了探测器空间分辨测试、中子能谱测试、能量分辨成像和不锈钢样品的布拉格成像。通过位置重建后，探测器位置分辨好于 20μm，时间分辨为 μs 级，中子能谱与中子监测器结果一致，不锈钢样品的布拉格边与理论符合。结果表明该探测器可以满足高空间分辨成像和布拉格边中子成像需求。

Parallel Session IX (5)：Particle Detector Technology / 197

The Development of 4H-SiC Detector for Fast Minimum Ionization Particle Detection

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Inspired by the Low Gain Avalanche Diode (LGAD), we investigate the possibilities to produce similar device using 4H-SiC, benefiting from the intrinsic characteristics of the wide band gap properties of Silicon Carbide, such as higher saturated carrier velocity, higher atom displacement energy as well as the recent technological improvement of high-quality epitaxy with high resistance from industry. We introduce the possible applications of 4H-SiC detectors to fast MIPs detection and the present R&D status of 4H-SiC LGAD. We provide guidance to determine the thickness and doping level of the gain layer of 4H-SiC LGAD by TCAD simulation. Two prototypes of 4H-SiC LGAD devices with different designs by Nanjing University (NJU) are characterized which target achieving low gain multiplication in 4H-SiC material.

Parallel Session IX (3)：Heavy Ion Physics / 198

Heavy quark potential and jet quenching parameter in a rotating D-instanton background

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We get the dual gravity metric of the rotating nuclear matter by performing a standard Lorentz transformation on the static metric in the D-instanton background. Then, we study the effects of the angular velocity, the instanton density and the temperature on the heavy quark potential. It is shown that the angular velocity and the temperature promote dissociation of the quark pair, and the instanton density suppresses dissociation. Similarly, according to the result of jet quenching parameter, we found that the jet quenching parameter increases with the increase of angular velocity, instanton density and temperature, and the jet quenching parameter in the rotating D-instanton background is larger than that of N=4 SYM theory.

Parallel Session IX (5)：Particle Detector Technology / 199

Study on ATLAS Inner Tracker strip module production rate

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The ATLAS Inner Tracker upgrade involves 30 many production sites to produce 18,000 large number of strip modules. To prepare against any need to increase module production rates at the stripe institutes, an investigation of a range of solutions to boos assembly throughput have been done. This inclues a multi-module bonding jig for increased wire bonding rates, ways to increase the number of vaccume assembly jigs safely in operation, and several other Quality Control (QC) processs, such as visual inspection, database interaction, that could benefit from increase throughtputs.

Parallel Session II (2)：Hadron and Flavor Physics / 200

Molecular tetraquarks and pentaquarks in chiral effective field theory

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We generalize the framework of chiral effective field theory to study the interactions of the isovector $D^*\bar{D}^{(*)}$ and $B^*\bar{B}^{(*)}$ systems up to the next-to-leading order, in which the long-, mid-, and short-range force contributions as well as the S-D wave mixing are incorporated. Based on the Lippmann-Schwinger equation, we fit the invariant mass distributions of the elastic channels measured by the BESIII and Belle Collaborations. Our results indicate that the four charged charmoniumlike and bottomoniumlike states $Z_c(3900)$, $Z_c(4020)$ and $Z_b(10610)$, $Z_b(10650)$ can be well identified as the $D\bar{D}^*$, $D^*\bar{D}^*$ and $B\bar{B}^*$, $B^*\bar{B}^*$ molecular resonances. The bound state explanations are vetoed in our framework. Our study favors the Z_c and Z_b states are the twin partners under the heavy quark symmetry.

The newly observed $P_c(4312)$, $P_c(4440)$ and $P_c(4457)$ at the LHCb experiment are very close to the $\Sigma_c\bar{D}$ and $\Sigma_c\bar{D}^*$ thresholds. In this work, we perform a systematic study and give a complete picture on the interactions between the $\Sigma_c^{(*)}$ and $\bar{D}^{(*)}$ systems in the framework of heavy hadron chiral effective field theory, where the short-range contact interaction, long-range one-pion-exchange contribution, and intermediate-range two-pion-exchange loop diagrams are all considered.

Parallel Session II (2)：Hadron and Flavor Physics / 201

Heavy flavor molecules

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We proposed a unified framework to describe the interactions of the observed T_{cc}, P_c, and P_{cs} within a quark level interaction. We predict the possible $D_{(s)}^{(*)}D_{(s)}^{(*)}$ molecular states in the SU(3) limit with the masses of the P_c states as the inputs. We also investigate the baryon-meson and baryon-baryon systems. We suggest that for a specific heavy flavor meson-meson, baryon-meson, or baryon-baryon system, the interactions for the states with the same flavor and spin matrix elements can be related by a generalized flavor-spin symmetry.

Summary:

The obtained results to the observed P_c, P_{cs}, and T_{cc} states indicate that the interactions of heavy flavor di-hadron systems may have a heavy quark spin and flavor symmetry. Specifically, the spin multiplets in the same system obey the heavy quark spin symmetry, for example, the $P_c(4312)$, $P_c(4440)$, and $P_c(4457)$. While different heavy flavor di-hadron systems obey the heavy quark flavor symmetry, for example, the observed P_c, P_{cs}, and T_{cc} states.

Parallel Session IV (2)：Hadron and Flavor Physics / 203

News of h_c and eta_c(2S) from BESIII

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With the worldly largest psi(2S) samples collected at BEESIII, systematic studies of the decays of eta_c(2S) are performed. As an example, the observation of the decay eta_c(2S) -> 3 (pi+ pi-) will be reported in this talk. Based on the 450M psi(2S) samples, the mass and width of h_c are updated as well as the branching fraction of psi(2S) -> pi0 h_c. In this talk, search for new hadronic decays of h_c and observation of h_c -> proton anti-proton eta will be reported too. And the upper limit of h_c -> pi0 J/psi will be provided. This analysis utilizes the electron-positron collision data at the energy regions above 4 GeV.

Parallel Session IV (2)：Hadron and Flavor Physics / 204

The cross-section measurements of electron-positron annihilation above 4 GeV

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To understand the nature of vector charmonium and charmonium-like states better, the measurements of the cross-section of e+ e- -> pi+ pi- J/psi, e+ e- -> K+ K- J/psi, e+ e- -> pi+ pi- psi2(3823), e+ e- -> D+ *D*- and e+ e- -> D*+ D- are performed at BESIII recently. This talk will include the new decay modes of the well-known resonance, such as Y(4230), and the new observed structures that strongly coupled to these channels.

Parallel Session VI (3)：Heavy Ion Physics / 205

Dielectron production in Au+Au collisions at $\sqrt{s_{\rm NN}} = 54.4$ GeV at STAR

作者： Zhen Wang[1]

[1] *Shandong University*

Dielectrons are excellent probes of the Quark-Gluon Plasma (QGP) created in high-energy heavy-ion collisions. Because they can be produced at all
stages of the collision system evolution and do not interact with the medium
strongly, dielectrons carry the information from the initial stage to the final
stage. In the low mass region ($M_{ee} < M_{\phi}$), the mass spectra of vector mesons
will be modified by the hot and dense medium which is related to the chiral symmetry restoration in the medium. In the intermediate mass region
($M_{\phi} < M_{ee} < M_{J/\psi}$), QGP thermal radiation can be used as a QGP thermometer. However, it is complicated to measure the QGP thermal radiation
because of the heavy flavor semi-leptonic decay contributions.

In this presentation, the result of the dielectron measurement in Au+Au
collisions at $\sqrt{s_{NN}} = 54.4$ GeV at STAR will be presented. With a 10 times larger data sample
than that at 62 GeV from the first phase of the STAR Beam Energy Scan
(BES-I) the program, the dielectron spectra can be studied with better precision. Furthermore, the physics
implications of these measurements will be discussed.

Parallel Session VI (5)：Particle Detector Technology / 206

Design of the Readout Electronics for the TRIDENT Pathfinder Experiment

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合作者： Jiannan Tang [2]; Peng Miao [3]; Weihao Wu [2]; Zhengyang Sun [2]

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The TRIDENT, also known as Hailing, is a possible large-scale next-generation neutrino telescope. In September 2021, the TRIDENT Pathfinder experiment completed in situ measurements of sea-water properties at a depth of 3500 m in the South China Sea. One light emitter module (EM) and two light receiver modules (RMs) were deployed, synchronized by White Rabbit technology. The EM generates nanosecond width LED pulses, while the RM hosts three PMTs and a CCD camera to detect photons. We report about the design and performance of the readout electronics for TRIDENT Pathfinder, including hardware modules, firmware design for digital signal processing and host-computer software.

Parallel Session I (5)：Particle Detector Technology / 207

CSNS 高能质子测试束实验终端的物理设计

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敬罕涛、樊瑞睿、董明义、钱森、梁志均、易晗、韩艳良、谭志新、李志平、周凯、陈佳鑫、王平、史欣、刘勇、孙志嘉、陈元柏

中国散裂中子源（CSNS）是一个多学科应用的科学研究平台。它的强流质子加速器可以提供稳定的 1.6GeV 的高能质子束流。在 CSNS 二期中将进一步提升质子束流功率到 500 kW。于此

同时，利用散射方式将 1.6GeV 引到高能质子实验大厅，提供专用的极弱高能质子测试束，用于新型先进粒子探测器的研发测试。另外，高流强也可以提供辐照效应等相关的研究。质子能量通过降能器可以在 0.8-1.6 GeV 之间调节。实验厅内规划了两个实验终端，分时利用束流。终端内配备了快触发探测头、高位置精度的望远镜测量设备、束流剖面等测量设备。终端建成后，将是国际上为数不多的专用高能质子测试束实验终端，为我国先进粒子探测器研发提供测试条件。

Parallel Session VII (5)：Particle Detector Technology / 209

单光子相机成像测量研究

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We will discuss an imaging measurement with a single photon sensitive and low noise camera aiming to a new paradigm in the optical readout of scintillation detectors. The features of the single photon sensitive camera will be characterized and demonstrated with a measurement on double-slit Young's interference in single photon mode. An imaging test on CsI(Tl) crystal and alpha source will be performed further for preliminary measurements on the noise level and sensitivity of the system with a 1/2", f/1.4 lens, which reaches an sensitivity on light intensity around 1/10 of the 3-inch PMT and shows a potential to realize an imaging of single alpha event. An application proposal to scintillation detectors will be further discussed, where it is usually assumed that the imaging is not possible in such a photon-starved and large-emittance regime.

Parallel Session IX (3)：Heavy Ion Physics / 210

RHIC-STAR 实验上超子整体极化和局域极化测量

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非对心相对论重离子碰撞中产生的系统具有极强的涡旋结构，垂直于反应平面方向的轨道角动量可导致末态超子的整体极化 (global polarization)，而沿着束流方向的集体流涡旋效应则导致超子的局域极化现象（local polarization）。基于 STAR 实验组采集的 200GeV 对撞能量下钌 + 钌和锆 + 锆碰撞的高统计量实验数据，我们测量了$\Lambda/\bar{\Lambda}$ 超子在不同碰撞中心度下的整体极化和局域极化。钌 + 钌和锆 + 锆碰撞系统中磁场效应的差异可能导致超子整体极化的差异，因而提供了探测磁场效应的可能手段。另一方面，STAR 实验首次测量了沿束流方向相对于三阶事例平面的超子局域极化，为理解其产生机制提供了全新的线索。此外，通过与金 + 金碰撞结果的对比，新的测量结果将会为研究重离子碰撞中涡旋结构的碰撞系统尺寸依赖提供重要的实验依据。

Parallel Session I (5)：Particle Detector Technology / 212

CSNS 白光中子束线探测器系统综述

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中国散裂中子源（CSNS）白光中子束线是国内为数不多的宽能谱高能中子束线。其能量范围覆盖从热中子到 200 MeV，通量最高可以达到 10^7 n/cm^{2}s。这条束线主要从事核数据测量、核物理等实验，同时也是高能中子探测器标定的重要装置。从 2018 年运行以来，白光中子束线已经进行了五十余种核素的中子俘获截面、裂变截面、全截面、带电粒子截面等多种截面测量实验。同时为了配合各类实验的不同需求，合作组研制了包括带电粒子探测器阵列、BaF_2 探测器阵列、多用途时间投影室、裂变电离室等多种探测器系统。

本报告将对这些探测器的研制和实验结果进行总结，并介绍探测器的未来发展计划，对未来白光中子束线上的探测器设备进行展望。

Summary:

中国散裂中子源（CSNS）白光中子束线是国内为数不多的宽能谱高能中子束线。其能量范围覆盖从热中子到 200 MeV，通量最高可以达到 10^7 n/cm^{2}s。这条束线主要从事核数据测量、核物理等实验，同时也是高能中子探测器标定的重要装置。从 2018 年运行以来，白光中子束线已经进行了五十余种核素的中子俘获截面、裂变截面、全截面、带电粒子截面等多种截面测量实验。同时为了配合各类实验的不同需求，合作组研制了包括带电粒子探测器阵列、BaF_2 探测器阵列、多用途时间投影室、裂变电离室等多种探测器系统。

本报告将对这些探测器的研制和实验结果进行总结，并介绍探测器的未来发展计划，对未来白光中子束线上的探测器设备进行展望。

Parallel Session V (5)：Particle Detector Technology / 214

高摩尔百分比 10B2O3 的微通道板中子成像探测器的研制

作者： liu 刘术林 [1]

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研制成两种结构的含有 10B2O3 的微通道板成像探测器，即真空密封结构和敞开式结构，两者均采用含 10B2O3 的微通道板作为中子转换和较低增益的电子倍增，随后采用高增益微通道板来倍增前者的电子，采用超短余辉的 P46 荧光屏来实现成像，而真空密封结构采用石英玻璃作为窗口，在其上蒸镀多碱阴极，按照微光像增强器的工艺制作，由此可以确保倍增和成像系统质量合格，采用 P46 的荧光粉，为后续高速相机采集成像数据奠定技术基础。

Summary:

Parallel Session IX (5)：Particle Detector Technology / 215

Study the method for measurement of an optimized LYSO energy resolution

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Compared with other scintillation materials used for scintillation detectors, the cerium-doped lutetium yttrium silicate (LYSO:Ce) crystal is found to feature high density, high light output, fast decay time and non-hygroscopic, showing great potential to improve the performance of scintillation detectors. Silicon photomultipliers (SiPMs) are the new type of high-performance semiconductor photodetector, which generally have a higher photon detection efficiency than photomultiplier tubes (PMTs) and are beneficial to realize a better energy resolution. The optimized energy resolution measurement of SiPM-coupled LYSO:Ce crystals were studied by optimizing the photon detection efficiency (PDE), the operating voltage, the wrapper, the surface finish and the coupling method between the SiPM and crystal, hoping to contribute to the design of scintillation detectors based on the LYSO:Ce crystal coupled with SiPMs. Considering the output saturation of SiPMs in a high light intensity, a preliminary correction method was applied to the saturation response of SiPMs and energy resolution of 662 keV gamma-rays from 137Cs was obtained after correction. The results show that the optimized energy resolution at 662 keV measured by the SiPM of 50 μm microcells can reach 7.6%. In this contribution, the measurement method for an optimized LYSO energy resolution is discussed in details.

Parallel Session IX (5)：Particle Detector Technology / 216

Silicon module assembly and QA/QC for HGCAL upgrade

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The CMS collaboration is designing a High Granularity Calorimeter (HGCAL) to replace the existing endcap calorimeter to face the 10-fold increase in integrated luminosity of LHC. The IHEP team is participating in the HGCAL upgrading project as one of six MACs worldwide, making over 5,000 silicon modules in total. A silicon laboratory has been constructed and the quality control procedures based on assembly process has been developed. As of July 2022, the IHEP team has successfully produced seven modules and passed the acceptance. This report will introduce the status of the lab, the assembly procedures, the quality control methods and the noise test of silicon modules.

Parallel Session I (5)：Particle Detector Technology / 218

The status of Cryogenics for the PandaX-4T and future PandaX-30T

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PandaX-4T is a xenon dual-phase detector with about six tons of liquid xenon as target for dark matter search, it runs for 2 years. The next generation is the PandaX-30T with about 50 tons of xenon. In this report, the performance of Pandax-4T cryogenics for the commission run (RUN1) and RUN2 are reported. Two coldheads (total: 3 coldheads) are enough, the static heat load is around

90W, outer vacuum is less than 2.4E-4Pa; the fluctuation of xenon pressure is less than 0.5%; the precision of xenon temperature is less than 0.1K. The average speed of online purifying xenon is around 100slpm (mainly LOOP1), maximum electron lifetime is around 2200 us (RUN2). Total radon level of PandaX-4T is less than that of XENON1T, however, the contribution of LOOPs is almost half. At last, the cryogenics design of PandaX-30T is introduced too.

Summary:

The cryogenics for PandaX-4T experiment runs for more than 2 years, it works well. The flow rate of LOOP1 is ~ 100 slpm for online purifying xenon, LOOP2 is mainly used for gas calibration and online distillation. The maxium e_lifetime is around 2200us. However, the radon contribution from KNF circulation pump is almost half of total radon background. It has to be improved in the future.
The cryogenics of PandaX-30T is on the way, its prototype will be tested in the next two years.

Parallel Session X(1)：TeV and BSM Physics / 221

Measurement of Zgamma plus jets differential cross section using 139 fb-1 data collected by the ATLAS detector

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Differential cross-section measurements of $Z\gamma$ production in association with hadronic jets are presented, using the full Run-2 proton-proton dataset of 139 fb^{-1} produced by the LHC at $\sqrt{s}$ = 13 TeV collected by the ATLAS detector. Distributions are measured using events in which the boson decays leptonically and the photon is predominantly radiated off the initial state quarks. Both one- and two-dimensional observables are considered, including distributions sensitive to the hard scatter in the event and observable which probe additional soft and collinear radiation. The measurements are compared to different Standard Model predictions, both parton-shower Monte-Carlo simulation and fixed-order QCD calculations. General good agreement is observed between data and state-of-the art theoretical next-to-nextleading-order predictions MATRIX/MiNNLO and with MadGraph5_aMC@NLO and Sherpa multileg next-to-leading order generators.

Parallel Session VI (1)：TeV and BSM Physics / 223

Celestial Non-Gaussianities in Collider Energy Flux

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Energy Correlators (EEC) have recently received great interest both theoretically and experimentally. In particular, the study of EECs in jet substructure has gained deeper understanding with the advent of the light-ray operator product expansion. In this talk, based on this progress, we propose a ratio observable named “celestial non-gaussianity” , which roughly is the ratio between three-point energy correlator and a product of two-point correlators. The underlying motivation for such a construction is to probe how the three-point function deviates from the factorization into a product of two-point functions in the squeezed limit. One salient feature of the “celestial non-gaussianity” is its robustness to hadronization effects. We compare our perturbative prediction with CMS Open

Data finding good agreement. We anticipate the celestial non-gaussianity and its possible generalizations will be helpful for future precision measurement of effects like spin correlations and the development of parton showers.

Parallel Session III (3): Heavy Ion Physics / 224

Search for the chiral magnetic effect in collisions between two isobars with nuclear structures

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Under the assumption of same background but different magnetic fields, isobaric collisions are believed to be an effective way to measure the anomalous chiral effects. The isobaric program at the Relativistic Heavy Ion Collider (RHIC) has been done by colliding $^{96}_{44}\mathrm{Ru}+^{96}_{44}\mathrm{Ru}$ and $^{96}_{40}\mathrm{Zr}+^{96}_{40}\mathrm{Zr}$, however, it reveals that the chiral magnetic effect (CME) background is different between the two species of isobaric collisions and the predefined CME signatures have not been observed in the blind experimental analysis 1.

We test eighteen cases of Woods-Saxon parameter settings which consider either nuclear deformation or nuclear neutron-skin effect for $\mathrm{Ru}+\mathrm{Ru}$ and $\mathrm{Zr}+\mathrm{Zr}$ collisions at $\sqrt{s}$ =200 GeV, using the AMPT model. Only seven of the eighteen cases (Case 3, Case 4, Case 5, Case 7, Case 9, Case 10, and halo-type case) can reasonably reproduce the experimental ratios of charged-particle multiplicity distribution, average number of charged particles and elliptic flow, which demonstrates that the nuclear deformation and structure information have a non-negligible impact. Isobar collisions can serve for further research of nuclear deformation or nuclear neutron-skin structure, which currently has important implications for both nuclear structure and nuclear astrophysics.

Utilizing the chi-square test χ^2, we choose the halo-type case to study the CME using the AMPT model with different strengths of the CME 2. The measured $\Delta\delta$, $\Delta\gamma$, $\Delta\delta$ ratio, and $\Delta\gamma$ ratio can be reproduced by the AMPT model without the CME or with a small strength of the CME. On the other hand, they can not be described by the AMPT model with a stronger strength of the CME. This indicates that the initial CME signal in isobar collisions is absent or small in isobar collisions. It could be due to the fact that the final state interactions significantly weaken the initial CME signal, resulting in the non-linear sensitivity of the CME observables. Therefore, more sensitive observables are required for searching for the possible small CME signal in isobar collisions.

1 M. Abdallah et al. [STAR], Phys. Rev. C 105.014901 (2022).

2 X. L. Zhao and G. L. Ma, [arXiv:2203.15214 [nucl-th]].

Parallel Session V (2)：Hadron and Flavor Physics / 225

Weak radiative hyperon decays in covariant baryon chiral perturbation theory

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Weak radiative hyperon decays, important to test the strong interaction and relevant in searches for beyond the standard model physics, have remained puzzling both experimentally and theoretically for a long time. The recently updated branching fraction and first measurement of the asymmetry parameter of $\Lambda \to n\gamma$ by the BESIII Collaboration further exacerbate the issue, as none of the existing predictions can describe the data. We show in this letter that the covariant baryon chiral perturbation theory, with constraints from the latest measurements of hyperon non-leptonic decays, can well describe the BESIII data. The predicted branching fraction and asymmetry parameter for $\Xi^- \to \Sigma^-\gamma$ are also in agreement with the experimental data. We note that a more precise measurement of the asymmetry parameter, which is strongly constrained by chiral symmetry and related with that of $\Sigma^+ \to p\gamma$, is crucial to test Hara's theorem. We further predict the branching fraction and asymmetry parameter of $\Sigma^0 \to n\gamma$, whose future measurement can serve as a highly nontrivial check on our understanding of weak radiative hyperon decay and on the covariant baryon chiral perturbation theory.

Parallel Session III (5)：Particle Detector Technology / 226

江门中微子实验 2 万吨液闪进展

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江门中微子实验正在建造一个国际领先的中微子实验站，距阳江和台山反应堆群约 53 公里，通过探测来自反应堆的中微子能谱，精确测量反应堆中微子的振荡信号，以确定中微子质量顺序，精确测量中微子混合参数，并进行其它多项科学前沿研究。其中心探测器位于地下 700 米，为一个质量 2 万吨的液体闪烁体探测器，能量分辨率将达到国际最优。2 万吨液体闪烁体由项目组自主研发、生产、灌装，实验对液闪提出了苛刻的性能指标要求，经过多年技术攻关，液闪生产设备已陆续进场安装调试，预计 2022 年底将完成全系统联调。本报告将介绍 2 万吨液闪的指标要求，原料配比，性能表现，生产工艺，生产设备，质检措施以及江门现场进展等。

Parallel Session VI (5)：Particle Detector Technology / 227

ATLAS 硅微条探测器读出芯片的单粒子效应研究

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ATLAS 实验二期升级拟将径迹探测器替换为全硅的探测器，包括内层的硅像素探测器和外层的硅微条探测器。硅微条探测器的读出采用前端专用集成电路（ASIC）ABCStar，该芯片集成 256 路模拟通道，将硅微条信号放大后，转换为数字信号并完成存储、簇寻找、打包输出等功能。在 HL-LHC 的辐照环境下，粒子打在芯片上引起寄存器等存储单元的翻转，将会带来探测器系统的工作失常和稳定性问题。本工作重点研究单粒子效应（Single Event Effect）对 ABCStar 的影响，内容包括测试系统搭建、实验取数和数据分析初步结果。

Parallel Session IX (5)：Particle Detector Technology / 232

“海铃探路者”实验中的相机刻度系统

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海铃计划（the TRIDENT experiment）是目前筹建于中国南海海域的新一代深海中微子望远镜实验，其主要科学目标是通过探测高能天体中微子来研究宇宙射线起源等重要物理问题。对于深海中微子望远镜而言，其所在的海水介质对于切伦科夫光子的散射和吸收效应将会直接影响探测阵列的方向指向能力以及能量阈值。此外，动态的海水介质也会导致其光学性质因时变化。本次报告将会介绍一种适用于未来海铃计划的基于 CMOS 相机的新型刻度系统，以实现对于深海海水的光学性质的实时、精确测量。为了实现初步的技术论证，2021 年 9 月，“海铃探路者”（The TRIDENT Pathfinder）实验搭载该系统，于南海西沙群岛附近 3500m 深海进行了首次实地测试，并最终成功解码了包括衰减长度，吸收长度等重要光学性质。

Parallel Session IX (5)：Particle Detector Technology / 234

A Boosted Decision Tree Model for the Positron Acceptance in the Muon g-2 Experiment

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A high-fidelity simulation is crucial in the study of systematic errors arising from beam dynamics and detector acceptance in the Muon g-2 experiment at Fermilab. Gm2ringsim, our current Geant4-based simulation package is computationally expensive and it has limited the amount of dataset that can be produced for various systematic studies. We propose a “divide and conquer” approach, where the typical Geant4 Monte Carlo simulation is divided into the beam and spin dynamics, muon decay, and positron detection. The last part which involves positron tracking and electromagnetic shower development in the calorimeter was modeled using time-efficient machine learning algorithms. In the first attempt, we trained an Adaptive Boosted Decision Tree (BDT) model to classify positron events according to the energy deposition. The performance of the model was compared with a heuristic variable cut approach. The model has a higher area under the Receiver Operation Characteristic (ROC) curve than the heuristic approach while maintaining high background rejection over a large range of signal efficiency. This demonstrates the potential of machine learning models for fast simulations.

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Parallel Session IX (5)：Particle Detector Technology / 235

基于 Geant4 的海水中光子传播模拟及海水光学性质解析

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具有足够探测能力的深海高能中微子探测阵列可以深刻促进中微子驱动的多信使天文学发展，加深对宇宙的认知以及极端条件下物理规律的理解。海铃计划 (TRIDENT) 旨在中国南海三千米以下深海建设大型中微子探测阵列，并于 2021 年 9 月进行了远洋选址预研 (TRIDENT Pathfinder)。选址预研实验主要考察深海原位海水的光学性质，为望远镜阵列设计提供关键参数输入。我们同时使用光电倍增管 (photon multiplier tube, PMT) 和照相机两套系统来测量海水的散射和吸收长度。为了精确构建光子中的海水传播模型，诠释两套系统测得的数据，论证相应的海水性质测量方法，我们进行了基于 Geant4 的模拟，刻画了光子在海水中经历吸收、瑞利散射和米散射后时间和空间分布。通过模拟以及调制与归一化，模拟空间分布能重现照相机系统中的照片，且模拟时间分布可以复现 PMT 系统测得的光子到达时间分布。

Parallel Session VII (5)：Particle Detector Technology / 237

“海铃探路者”实验中的 PMT 系统

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“海铃计划”(The TRIDENT) 是正在筹备中的位于中南南海的下一代中微子望远镜项目。为刻画预选海域的性质，” 海铃探路者” (The TRIDENT Pathfinder) 项目于 2021 年 9 月在南海西沙群岛附近完成海试。此次海试最主要科的学目标是测量原位海水光学的性质，为后期探测器阵列设计，及利用切伦科夫光进行中微子重建提供关键数据。“海铃探路者”测量系统由三个光学球舱组成，其中包含一个发光球舱和两个接收球舱。每一个接收球舱搭载了三个海南展创生产的 3 英寸光电倍增管（PMT）。本次报告将会介绍 PMT 测量系统的设计理念，低温刻度实验情况，以及海试中的性能表现。

Parallel Session V (5)：Particle Detector Technology / 238

低本底钛冶炼工艺研究

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以暗物质、无中微子双贝塔衰变探测为代表的稀有事例实验所期望的信号极其稀少与微弱，对探测器所用材料的放射性本底要求日益苛刻，低本底控制一直是此类实验的核心工作。本文总结了已有低本底材料的获得方法，考虑到 238U、232Th 衰变链的放射性特点以及前端的 226Ra 和 224Ra 具有低沸点高蒸气压的特点，去除 Ra 就可以一定程度上截断 238U 衰变链或者在一定时间内控制 232Th 衰变链后端活度，从而降低对稀有事例实验有明显负面影响的核素含量，为探测器运行创造低本底环境。高温高真空环境有助于 K、Cs、Ra、Pb、Po、Rn 等低沸点高蒸汽压杂质的挥发，真空冶炼试验结果证明了真空冶炼去除放射性核素的可行性。在

真空电子束炉中冶炼的纯钛，本底放射性明显优于核级不锈钢，为下一代 PandaX 探测器提供了可靠的低本底材料保障。

Summary:

真空电子束炉获得的低本底钛重复性稳定性较好，232Th-228Ac 可达 0.13±0.69，238U-222Rn 可达 0.07±0.29，可用于制造下一代 PandaX 探测器压力容器。同时高纯锗谱仪对放射性核素含量有极高的测量灵敏度，金属材料中固有的放射性核素有望作为冶金学研究的天然示踪剂。

Parallel Session IV (5)：Particle Detector Technology / 239

无中微子双贝塔衰变实验 NvDEx

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无中微子双贝塔衰变实验是研究中微子 Majorana/Dirac 属性的最佳手段。如果发现这种衰变，将证明中微子是自己的反粒子，突破粒子物理标准模型。报告将介绍基于高压 82SeF6 气体时间投影室，采用 Topmetal 芯片读出的无中微子双贝塔衰变实验 NvDEx。重点介绍 NvDEx 实验概念的独特优势，以及当前的研制进展情况。

Parallel Session VI (5)：Particle Detector Technology / 240

基于 100G 以太网和 GPU 的 4G 采样率实时信号处理系统

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目前国际上地面的宇宙微波背景辐射（Cosmic Microwave Background，CMB）观测实验普遍采用大阵列的超导转变边沿探测器（Transition Edge Sensor, TES）来实现高灵敏的信号探测。这对室温电子学读出系统提出了低噪声、高速数据流处理、实时计算以及高稳定性的要求。针对以上要求，我们基于 Xilinx ZCU111 实现了 4GSPS 的波形采样、100G 以太网传输和 GPU 实时数据处理。该方案中原始波形采样数据可以无损传输至上位机，实现了将传统的数据处理单元从 FPGA 端到 GPU 端的迁移，一方面缓解了前端的资源压力，另一方面也为更复杂的数据处理算法提供了可能性。未来我们还将针对天文领域多物理目标的特点，将已有的 100G TCP/IP 协议升级为定制 RoCEv2 协议，以满足单节点对多节点的高可靠性数据广播。

Parallel Session II (1)：TeV and BSM Physics / 241

Complementary constraints on Zbb couplings at the LHC

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As one of those long-standing experimental anomalies from the LEP era, albeit mild, the discrepancy to the standard model prediction in the $Zb\bar{b}$ coupling keeps drawing attention over the years as the

LHC accumulates data. So far, differential data and studies from electroweak production of the bb pair and other potentially sensitive channels at the LHC and LHCb are yet to become competitive with the existing Z-pole measure from LEP. We propose in this study to look at another LHC signal, the $b\bar{b} + Z/\gamma(\to \ell\ell)$ associated production, both on and off-Z-mass-shell region. The varying dependence on the concerned couplings through interplay of Z and photon interference pattern in the $b\bar{b}\ell\ell$ final states offer distinct constraint power.

Parallel Session IV (5)：Particle Detector Technology / 243

R&D of High pressure gaseous TPC for double beta decay

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The PandaX-III experiment (particle and astrophysical xenon experiment III) aims to search for neutrinoless double beta decay (0νββ) of 136Xe using a high pressure gaseous time projection chamber (TPC). The TPCs use Micro-pattern gas detectors (Micromegas) as the charge readout, registering both the energy and the track information of an event. A prototype detector with thermal-bonding Micromegas has been successfully built and commissioned. Detector performance at different pressure up to 10 bar was studied with several gamma calibration sources. We report the operating conditions and detector performance such as gain, gain stability, and energy resolutions in this presentation.

Parallel Session II (5)：Particle Detector Technology / 244

AMS L0 硅径迹室的升级

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AMS 自 2011 年开始在国际空间站上运行，迄今已在暗物质和反物质寻找、宇宙线研究取得重大成果，发现了许多不能被现有理论解释的新现象。美国白宫已于 2021 年 12 月 31 日宣布国际空间站将运行到 2030 年，并计划运行 AMS 直到国际空间站使命结束。为进一步提高 AMS 科学产出，理解已发现的新现象，特别是宇宙线正电子、反质子和高电荷原子核能谱的精确测量，更好地发挥在反物质等探索研究方面独到的优势，AMS 实验计划于近期开始进行探测器升级，安装由两层共 8 平方米的硅微条探测器组成的 Layer0 硅径迹室。
中科院高能所将负责完成 L0 硅径迹室的全部硅探测器的研制，并参加其总体集成和空间环境模拟试验。AMS 实验的其它国际合作者将负责读出电子学、机械结构、冷却、供电、空间验证和安装等，NASA 已基本同意中国科学家以这种方式参加升级项目。探测器整体精度要求 10 微米，是一项前所未有的挑战。本文将向大会介绍 AMS L0 硅径迹室升级的建造方案，并汇报进展情况。
本次升级对中国科学家而言，既可以掌握先进的硅探测器技术，也可以了解相关空间技术及

质量控制，对中国下一代的空间科学项目，如中国空间站上的 HERD 实验具有十分重要的意义。

Summary:

Parallel Session IX (5)：Particle Detector Technology / 245

基于圆柱形 μRWELL 的超级陶粲装置内径迹探测器研究

作者： Zhujun Fang[1]

合作者： Jianbei Liu [2]; yi zhou [2]

[1] *USTC*

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以 CGEM 探测器为代表的 MPGD 探测器已逐渐应用于粒子物理实验，展示了良好的实验性能，但也表现出结构复杂、物质量偏高的问题。μRWELL 探测器能以单级实现足够增益，具有很好的粒子物理探测应用前景。基于超级陶粲装置（STCF）内径迹探测器的应用需求，我们设计了一种圆柱形 μRWELL 探测器，其具有低物质量、高计数率、高性价比等特点。我们同时针对 STCF 磁场环境对探测器做了参数与位置分辨算法的优化，以实现更好的性能。研究表明，单层探测器物质量约 0.25%-0.3% X/X0，rφ 向与 Z 向位置分辨分别好于 100μm 与 450μm，能够有效辅助主漂移室实现带电粒子的径迹探测。

Parallel Session I (5)：Particle Detector Technology / 246

新一代高能量粒子对撞机超导磁体技术研究进展

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中科院高能物理研究所联合国内相关实验室，正在开展针对下一代高能量粒子对撞机的先进超导磁体技术预研: 国内提议建设的正负电子对撞机-超级质子对撞机 CEPC-SPPC，以及欧洲 CERN 提出的未来环形对撞机 FCC，均对超导磁体技术提出了新的高要求。CEPC 粒子探测器需要在厚度 150mm 范围内提供一个 3 特斯拉（T）的大孔径螺线管磁场，SPPC 为达到 75-150 TeV 的质心对撞能量，需要在周长 100 km 的地下隧道内安装数千台场强 20 T 的超导二极及四极磁体。高能所超导磁体团队正在开展针对性的预研，并已取得重要进展：国产化铝基卢瑟福电缆研制成功，国产化二极磁体样机达到 12 T。SPPC 高场超导磁体拟以全新的铁基超导技术为首选路线：原材料成本低、制作工艺简单且具有优良的强场下电磁及机械性能。在后续十年，超导磁体团队将联合国内相关实验室，完成实用化铁基超导线材的性能进一步提升、长线产业化及铁基高场超导磁体样机的研制，同时稳步推进基于 Nb3Sn 及 ReBCO 等超导材料的高场超导磁体技术研究。性能大幅度提升的新一代高场超导磁体技术，不仅在粒子加速器领域，在其它大科学工程领域（核聚变装置等）及民用领域（核磁谱仪等），也有着广泛的应用前景。本文将对相关研究目标、近期进展及未来计划做简要介绍。

Parallel Session II (3)：Heavy Ion Physics / 247

Longitudinal flow decorrelation in ^{96}Zr+^{96}Zr and ^{96}Ru+^{96}Ru collisions within a multiphase transport model

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Longitudinal fluctuation which is the initial geometry fluctuates along pseudorapidity η, is found to be significantly important in understanding the full space time evolution of the fireball. Recent studies show that anisotropic flow coefficients are also sensitive to the shape of the nuclei, owing to the intrinsic deformation, while the deformation effect on the longitudinal physics is not studied in those deformed collision systems. With a multiphase transport model, we conduct the systematic study on longitudinal flow decorrelation in the deformed Zr+Zr and Ru+Ru collisions. The results suggest the strength of flow decorrelation can be suppressed via the hadronic transport process. The longitudinal flow decorrelation also show sensitivity on the shape of the nuclei, with a $\beta_{2,Ru} \gg \beta_{2,Zr}$ and $\beta_{3,Ru} \ll \beta_{3,Zr}$, clear difference is observed in r_2 in mid-central collisions and r_3 in central collisions between the two collision systems. Our results suggest longitudinal flow decorrelation can provide new constrains on the nuclear structure study in heavy-ion collisions.

Parallel Session IX (5)：Particle Detector Technology / 248

Performance of carbon implantation LGAD developed by IHEP and IME

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Low Gain Avalanche Detector (LGAD) with time resolution better than 50 ps has been choose as the sensors for ATLAS High Granularity Timing Detector (HGTD) project and have so far been developed by several institutes. This poster will show measurement results of carbon implantation LGAD sensors designed by the Institute of High Energy Physics (IHEP) and fabricated by Institute of Micro Electronics (IME). The time resolution of IHEP-IME LGAD sensors are better than 35 ps and the collected charges are larger than 30 fC before irradiation. After irradiation fluence of 2.5 × 1015 neq/cm2, the collected charges of the IHEP-IMEv2 LGAD reaches 4 fC with a time resolution of better than 50 ps at 400 V. The operating voltage of the IHEP-IMEv2 sensors can effectively avoid the single event burnout effect.

Parallel Session VI (5)：Particle Detector Technology / 249

CEE 径迹探测器前端读出电子学研究进展

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合作者： 乾顺佘 [2]; 天磊蒲 [1]; 志朋孙 [3]; 江月袁 [4]; 洁孔 [5]; 红🄴赵 [2]; 长鑫王 [5]

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低温高密核物质测量谱仪 (CSR External-target Experiment, CEE)，是适用于 HIRFL-CSR 能区重离子碰撞和质子-重离子碰撞测量的带电粒子谱仪，该谱仪由若干子探测器系统组成。其中高计数率，高接受度的大型 TPC 探测器和大面积的 MWDC 探测器是 2 个重要的径迹探测器，用来鉴别带电粒子，并实现带电粒子的径迹测量。由于探测器计数率高、通道多等特点，目前的读出电子学无法满足需要，因此迫切需要研制适用于高计数率、低功耗的新型读出电子学。报告分别介绍了 CEE-TPC 前端读出电子学的研制进展，和 CEE-MWDC 前端读出 ASIC 芯片的研制和应用。

Parallel Session IV (5)：Particle Detector Technology / 252

热压接 Micromegas 探测器技术及其应用

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微结构气体探测器（MPGD）是当前气体探测器研究的技术前沿，微网格气体探测器（Micromegas）是其中的典型代表，在粒子物理实验中应用广泛。中科大 MPGD 团队基于自主研发的热压接方法，开展热压接 Micromegas 制作工艺和性能研究，开发了具有自主知识产权的探测器工艺方案和专用设备，实现了大面积高性能 Micromegas 探测器的批量化制造。基于此，中科大团队针对粒子物理实验与其它辐射探测应用中的指标需求，不断提升探测器制作方法与工艺，突破探测器极限性能，实现了该技术在科学实验工程中的落地应用。在 PandaX-III 实验的工程研究建造中，团队研制的低本底、高分辨的热压接 Micromegas 探测器，替代了性能未达标的进口探测器，其放射性本底水平与径迹测量精度关键指标将优于国际同类实验。为满足中国散裂中子源（反角白光中子源）和新型辐射治疗（BNCT）高分辨成像型中子探测器需求，研制了基于热压接 Micromegas 的高计数位置灵敏型中子探测探测器，对热中子实现亚毫米量级分辨。此外，还为下一代对撞机实验预研研制了基于 MPGD 的 RICH 探测器样机，为缪子成像应用研究研制大面积高分辨径迹探测器等。

Parallel Session IX (5)：Particle Detector Technology / 253

The High-Granularity Timing Detector module flex design and simulation for the ATLAS Phase-II upgrade

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The High-Granularity Timing Detector(HGTD), based on low gain avalanche detector technology, is proposed for the ATLAS Phase-II upgrade. HGTD is proposed in front of the Liquid Argon end-cap calorimeters for pile-up mitigation and improve forward performance by combing high-precision time measurement and ITk (new ATLAS tracker) position information.

The basic component of the HGTD is the module. A detector module consists of a sensor bump-bonded to two readout chips which are in turn connected to a module flex and flex tail. Module flex is a kind of flexible PCB which need to transfer signals, ground, power and controls between module flex and bare module(sensor+2ASICS). The module flex needs to have good performance in order to meet the requirements of HGTD excellent time resolution (˜30-50 ps/track) and multi-channel readout (450 channel/module).

IHEP fully undertakes the design and production task of HGTD module flex (~10000 module flex). Three kinds of module flex with different ground and power configuration are designed. At the same time, the power integration simulation of module flex was also done to ensure the performance of module flex at the simulation level.

Summary:

Module flex is very important for sensor(Low Gain Avalanche Detector, LGAD) signal transmission and peripheral electronic readout. In this poster, we will show the design of module flex (wire bonding, grounding option, PCB design) and the results of power integrity simulation.

Parallel Session IX (5)：Particle Detector Technology / 256

HERD 穿越辐射探测器 TeV 能区能量标定研究

作者： Hb liu[1]

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中国空间站高能宇宙辐射探测设施（HERD）的核心科学目标是搜寻暗物质粒子，探究宇宙线起源、加速与传播等问题。HERD 穿越辐射探测器（TRD）将实现在轨 TeV 能区的宇宙线质子的洛伦兹因子测量，用于对 HERD 量能器进行 TeV 能区的绝对能量标定。TRD/HERD 采用全新的侧窗式结构，能够有效提高穿越辐射探测器灵敏度，精确测量入射粒子的洛伦兹因子。TRD 原理样机经过 CERN、DESY 以及 IHEP 的电子束流实验验证，能够满足 TeV 能区的绝对能标需求。

Parallel Session V (1)：TeV and BSM Physics / 259

The analogy of LV fermion-gravity and fermion-photon couplings

作者： Zhi Xiao[1]

合作者： Cheng Ye [2]

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By adopting a non-relativistic (NR) reduction method, we study the one-fermion matrix elements between the fermion-gravity and the fermion-photon interactions in the presence of the minimal Lorentz-violating (LV) fermion coefficients. We prescribed the Lense-Thirring (LT) metric with the test particle assumption, as this metric is essentially curved and may demonstrate some novel LV matter-gravity couplings beyond the conventional test of equivalence principle.
With some bold but reasonable assumptions, we get a LV spin-gravity interaction Hamiltonian, from which we derive the LV corrected spin precession and gravitational acceleration.
With some ad hoc assumptions, we get some very rough bounds on several LV coefficients, such as $|3\vec{H} - 2\vec{b}| \leq 1.46 \times 10^{-5}\mathrm{eV}$,
from those spin-gravity measurements like the Gravity Probe B (GPB).

Parallel Session VIII (3)：Heavy Ion Physics / 260

Overview of RHIC Spin Program

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Understanding the spin structure of nucleon is a longstanding and fundamental challenge in nuclear physics. The Relativistic Heavy Ion Collider (RHIC), s the world only polarized proton collider, has provided unique opportunities to access the spin dependent distributions inside proton. In the past two decades, RHIC has carried out a lot of unprecedented experimental constraints on nucleon spin structure. The featured measurements include the helicity dependent distributions of gluons and sea quarks, transverse momentum dependent (TMD) parton distributions inside proton. In this talk, an overview of RHIC spin program and some selected recent results will be presented.

Parallel Session VIII (5)：Particle Detector Technology / 261

大型中微子射电探测望远镜 GRAND-原型阶段数据获取系统设计

作者： 慎汪 [1]

合作者： 建华郭 [1]; 毅张 [2]

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大型中微子射电探测望远镜项目 GRAND，计划建设工作在 50-200 MHz 低频波段的 20 万组由极化天线单元组成的自触发天线阵列，发展利用低频射电信号探测超高能宇宙射线的方法，探测超高能宇宙射线和中微子。

原型阶段将建成一个由 300 个天线单元组成的全极化低频射电探测阵列，实现对高能粒子簇射产生的低频射电信号的全自动、自触发探测。

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 262

格点 QCD 在介子衰变辐射修正中的应用

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[1] *Peking University*

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γW -box 图修正是电弱辐射修正中对强子尺度敏感的唯一项, 且对强子尺度敏感. 我们组将格点 QCD 引入π 介子的辐射衰变修正计算中, 在计算中结合格点理论和微扰论, 将理论计算的不确定度降低为原来的 1/3. 此外, 这一计算方案还可以在味 SU(3) 极限下推广到 K 介子衰变的辐射修正的计算中. 结合手征微扰论, 我们的计算方案可以给出又良好不确定度估计的低能有效常数的结果.

Parallel Session VI (1)：TeV and BSM Physics / 265

费曼积分的计算方法及在电子对撞机过程中的应用

作者： 滟青马 [1]; 相陈 [1]; 鑫关 [1]

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未来电子对撞机将带来前所未有的精确实验结果，这有助我们加深对标准模型的理解以及寻找新物理。为了给出高精度理论预言，我们需要将微扰论计算推进到更高阶, 其核心在于费曼积分的计算。我会在报告中介绍当前计算费曼积分的主流方法、发展以及在物理过程中的应用。

Parallel Session VI (1)：TeV and BSM Physics / 266

自举方法在形状因子计算中的应用和最大超越度原理

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在过去二十年里，现代散射振幅理论发展了许多新的方法，在计算和理解量子场论中与散射过程相关的可观测量方面也得到了许多新的结果，它们为许多高能物理现象提供了更为精确的理论预言与解释。而近些年，起源于上个世纪 S-matrix program 思想的自举 (bootstrap) 方法，在计算场论中的物理量方面有一些重要的进展。要计算量子场论中的物理量，往往需要大量极其繁琐的中间步骤，而最终结果有时是极其简单的。因此，自举方法的主要思想，便是通过合适地假设具有一般形式的结果，再利用一些已知的物理约束，直接限定得到最终结果，从而省去了不必要的中间过程。除此之外，不同理论往往满足一些普适的物理约束，这能用于解释不同理论结果之间的唯一性，例如最大超越度原理。这一原理是指，在最大超对称杨-米尔斯理论 (N=4 SYM) 和量子色动力学理论 (QCD) 中，对于一类物理量，如反常量纲、形状因子的圈图修正等，其最大超越度部分是相同的。本次报告将介绍利用基于主积分 (master integral) 的自举方法计算量子场论中的两圈四点形状因子的相关进展，我们使用利用了红外发散、共线因子化、非物理极点消除、幺正性等物理约束，得到了形状因子的圈图修正中最大超越度部分的结果。由于这些物理约束具有一定意义上的一般性，因此它们也可以用于讨论最大超越度原理。

Parallel Session VII (2)：Hadron and Flavor Physics / 273

Experimental expressions of emergent hadron mass

作者： Craig Roberts[1]

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The best understood mechanism for the generation of mass within the Standard Model is connected with the Higgs boson. Yet, alone, the Higgs can only explain a few percent of the proton mass. The remainder must be explained by another source. Contemporary theory indicates that the answer

lies in nonlinear, nonperturbative phenomena within the gauge sector of quantum chromodynamics; indeed, at the most fundamental level, in the emergence of a mass-scale for gluons. This presentation will sketch how gluons acquire mass, describe the manner through which this mass enters the matter sector, and highlight some of the observable consequences of such emergent hadron mass, e.g., in the semileptonic decays of mesons containing at least one heavy quark.

Parallel Session IX (1)：TeV and BSM Physics / 274

The W boson Mass and Muon g-2 : Hadronic Uncertainties or New Physics ?

作者： Andrew Fowlie[1]

合作者： Chih-Ting Lu [1]; Lei Wu [1]; Peter Athron [1]; Yongcheng Wu [1]; bin zhu [2]

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There are now two single measurements of precision observables that have major anomalies in the Standard Model:
the recent CDF measurement of the W mass shows a 7σ deviation and the Muon $g-2$ experiment at FNAL confirmed a long-standing anomaly, implying a 4.2σ deviation.
%
Doubts regarding new physics interpretations of these anomalies could stem from uncertainties in the common hadronic contributions.
We demonstrate that the two anomalies pull the hadronic contributions in opposite directions by performing electroweak fits in which the hadronic contribution was allowed to float.
%
The fits show that including the $g-2$ measurement worsens the tension with the CDF measurement and conversely that adjustments that alleviate the CDF tension worsen the $g-2$ tension beyond 5σ.
%
This means that if we adopt the CDF W mass measurement, the case for new physics in either the W mass or muon $g-2$ is inescapable regardless of the size of the SM hadronic contributions.
%
Lastly, we demonstrate that a mixed scalar leptoquark extension of the Standard Model could explain both anomalies simultaneously.

Parallel Session IX (5)：Particle Detector Technology / 275

Latest results of a monlithic active pixel sensor prototype for the CEPC vertex detector

作者： Tianya WU[1]; Wei WANG[2]

合作者： Joao Guimaraes Costa ; Wei WEI [3]; Ying ZHANG [2]

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The proposed Circular Electron Positron Collider (CEPC) imposes new challenges for the vertex detector in terms of high resolution, low material, fast readout and low power. A Monolithic Active

Pixel Sensor (MAPS) prototype, called TaichuPix, based on a data-driven structure and a column drain readout architecture, has been implemented to achieve fast readout. This poster presents the charge collection performance of TaichuPix2 by using a radioactive source. At the same time, an infrared laser setup was used to verify the spatial resolution, which indicates a spatial resolution better than 5 μm.

Parallel Session IX (2)：Hadron and Flavor Physics / 276

Renormalization of the flavor-singlet axial-vector current and its anomaly in dimensional regularization

作者： Long Chen[1]

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The renormalization constant of the flavor-singlet axial-vector current operator with a non-anticommuting γ_5 in dimensional regularization is determined to order α_s^5 in QCD with massless quarks. The result is obtained from a four-loop calculation by the virtue of a formula derived using the Adler-Bell-Jackiw equation in terms of renormalized operators. A possible application of this result for resumming the non-decoupling mass logarithms in the axial quark form factors will be discussed.

Parallel Session VIII (1)：TeV and BSM Physics / 277

New developments on Feynman integrals calculation

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We proposed a recipe to systematically calculate Feynman integrals containing linear propagators using the auxiliary mass flow method. The key of the recipe is to introduce a quadratic term for each linear propagator and then using differential equations to get rid of their effects. As an application, we calculated all master integrals of vacuum integrals containing a gauge link up to four loops, and we checked the results by nontrivial dimensional recurrence relations.

Summary:

In summary, we develop a recipe to calculate linear integrals using the AMF method. For any given linear integral, our recipe is to introduce an auxiliary quadratic term for each linear propagator, and the obtained auxiliary quadratic integral can be calculated systematically using the AMF method. Taking the result of the auxiliary quadratic integral calculated at fixed auxiliary quadratic terms as the boundary condition and using differential equations to push the auxiliary quadratic terms to zero, effects of auxiliary quadratic terms will die out eventually, and we get the result of the target linear integral. This recipe of calculating linear integrals is very systematic and has been implemented in the package~\texttt{AMFlow}.

As linear integrals show up frequently in region expansion and in effective field theories, our recipe will be useful in phenomenological studies. As the first application, we have calculated all MIs of vacuum integrals containing a gauge link up to four loops,
which are useful to study parton distribution functions. Our results have been checked by nontrivial dimensional recurrence relations.

Parallel Session III (1)：TeV and BSM Physics / 278

The study of the aQGC and nTGC

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In the SM effective field theory (SMEFT), the gauge interactions can be extended by dimension-8 operators contributing to anomalous triple gauge couplings (aTGCs) and anomalous quartic gauge couplings (aQGCs). The VBS processes at hadron colliders and the tri-boson production at lepton-colliders are suitable for probing aQGCs, and the di-boson production at lepton-colliders is suitable for studying nTGCs. We discuss the event selection strategies for measuring aQGCs or nTGCs, and give constraints on the anomalous gauge couplings. The validity of SMEFT has been taken into account in our works.

Parallel Session VI (5)：Particle Detector Technology / 280

为宇宙线 muon 成像设计的基于 HTM 方法的无触发电子学

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对于 muon 成像而设计的光纤闪烁体探测器需要上千的电子学读出 channels，针对该问题，设计一套无触发的
多板同步数字获取（DAQ）系统，其单板 ADC 可搭载 4 片 64 通道的 sigma delta ADC，其过采样的方法，以及内嵌的数字整形滤波模块帮助更好的还原模拟信号，这里将对该 ADC 性能进行测试，包括 ENOB，SFDR 等，并与官方结果比较。数字化信号由 FPGA 接收，并借助 SFP+ 接口与 PC 端形成交互。为解决多板同步问题，对于数字化前端部分，通过设计时钟板为整个 DAQ 系统提供同源时钟；对于后端，方法是 FPGA 内部实现对数字信号的解码以及通过 self-trigger 算法对有效信号进行判选，通过加入时间戳的方式实现多板 FPGA 上传 PC 端的同步。最后, 在 server 端将数据包拆分，实现数据同步。在 PandaX-4T 中，由于信号源数据有较大的带宽输入，导致在 server 端调用内存对数据包进行接收排序的时候出现拥堵，这里将在 FPGA 端加入修正，用首尾标记（HTM）方法缩小数据包大小，减小 server 的内存调用压力, 实现系统多板同步。

Summary:

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 282

Delta 低能激发态的内部结构

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重子及其宇称对偶态对于我们理解 QCD 的手征对称性动力学破缺具有非常重要的作用，同时一个完整的量子系统态空间不仅包含基态，还包含非常多的激发态，而大部分相互作用细节都隐藏在激发态中。

在本工作中，我们首次利用满足 Poincaré 对称性的量子场论中描述三体束缚态的 Faddeev 方程研究了$(I, J^P) = (\frac{3}{2}, \frac{3}{2}^{\pm})\Delta$ 共振态及其宇称对偶态的基态和第一径向激发态的质量谱，与实验结果是一致的。同时我们利用求得的 Faddeev 波函数分析了它们的内部组分构成。我们采用了 quark-diquark 图像，分别从 diquark 和角动量分波两个角度进行分析。

对于 diquark 构成，我们分析各个 diquark 道对质量和 Faddeev 振幅的贡献占比，发现轴矢量 diquark 对 Delta 重子占据主导贡献.

对于角动量构成，我们也分析各个角动量分波对质量和 Faddeev 波函数的贡献占比；更进一步地，我们计算了各个角动量分波对重子 Faddeev 波函数的正则归一化系数的贡献，也就是对零动量转移处的电磁形状因子的贡献。从主导波的角度讲，正宇称的$\Delta(1232)\frac{3}{2}^{+}$ 和$\Delta(1600)\frac{3}{2}^{+}$ 与夸克模型是一致的，都是 S 波；负宇称的$\Delta(1700)\frac{3}{2}^{-}$ 与夸克模型也是一致的，都是 P 波；但$\Delta(1940)\frac{3}{2}^{-}$ 与夸克模型不同，我们的结果显示它是 S 波占主导。这个不一致还有待实验的进一步验证，比如大动量转移处的电磁形状因子等。

以上研究从连续场论方法角度揭示了 Delta 共振态及其宇称对偶态的内部结构，将有助于加深我们对手征对称性动力学破缺以及 QCD 相互作用的理解。

Summary:

利用连续场论方法中的满足庞加莱对称性的 quark-diquark Faddeev 方程，我们求解并研究了$\Delta(J^P = \frac{3}{2}^{\pm})$ 的基态以及第一径向激发态的质量谱及其内部的 diquark 与角动量组分构成，计算了正则归一化系数（零动量转移处电磁形状因子）的的角动量分解。其中质量谱与实验结果一致。同时，diquark 组分分析表明，轴矢量 diquark 在Δ 的这四个低能激发态中占据绝对的主导地位，即使忽略矢量 diquark 也能给出可信的结果。最后角动量分析表明，$\Delta(1232)\frac{3}{2}^{+}$ 和$\Delta(1600)\frac{3}{2}^{+}$ 都是 S 波主导；$\Delta(1700)\frac{3}{2}^{-}$ 与是 P 波主导；而$\Delta(1940)\frac{3}{2}^{-}$ 的结果显示它是 S 波占主导。这些预言从连续场论方法角度揭示了 Delta 共振态及其宇称对偶态的内部结构，还有待实验的进一步验证，比如大动量转移处的电磁形状因子等，它们将有助于加深我们对手征对称性动力学破缺以及 QCD 相互作用的理解。

Parallel Session VII (1)：TeV and BSM Physics / 284

未来正负电子对撞机上类轴粒子的搜寻

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我们分别研究了当 FCC-ee 作为未来 Z 玻色子工厂运行时通过 Z → a f \bar{f} 过程以及在质心能量为 240GeV 的 CEPC 上通过 e^{+} e^{-} → a γ → 3 γ 过程对于类轴粒子物理信号（ALPs）的搜寻，并对类轴粒子的信号和相应的背景进行蒙特卡洛模拟分析，给出了探测类轴粒子与规范玻色子耦合系数的预期约束范围。对于前者，我们考虑了衰变道 a → μ^{+} μ^{-} 以及 a → b \bar{b}，探究了 μ^{+} μ^{-} \slashed{E}, b b \slashed{E}, e^{+} e^{-} μ^{+} μ^{-} 以及 e^{+} e^{-} b b 这四种信号。我们发现类轴粒子在高能正负电子对撞机上能够产生丰富的物理现象，在未来的正负电子对撞机上有可能探测到这些新物理迹象。

Parallel Session VI (2)：Hadron and Flavor Physics / 285

轻 + 重赝标介子半轻衰变的 DSE 研究

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Dyson-Schwinger 方程 (DSEs) 已被广泛地应用于轻 + 轻、轻 + 重和重 + 重介子性质的研究。基于此方法，我们对轻 + 重介子的每个半轻衰变的形状因子和衰变宽度进行了计算，包括 B_((s))→π(K), D_s→K; D→π,K, K→π 和 B_c→η_c, ⊠/⊠。在这些计算中，我们的结果定量地与现有数据一致，并分析了迄今未测量的 D_s→K^0, B¯*s→K^+ 形状因子。分析给出 |⊠⊠⊠ | = *0.974(10)*，并预言了赝标量介子的所有分支分数比，如 *B_c→η_c,* ⊠⊠ 的分支分数比，即 ⊠ 和 ⊠ 末态分支比的比值: *R*(η_c)= 0.313(22) 和 R_(J/ψ)= 0.242(47)，可以探讨轻子味道的普适性问题。我们的分析证实了标准模型对 R_(J/ψ) 的预言与唯一的实验结果之间存在 2⊠ 的差异，需要实验进一步验证。

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 286

赝标介子到矢量介子的半轻转变

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我们使用对称性保持的接触相互作用模型，系统地分析了十二个赝标介子到矢量介子的半轻衰变过程：D → ρ, Ds →K, *D →K*, Ds →Φ, Bc →D, *B →D*, Bs →Ds, *Bc →J/Ψ, Bc →Bs*, Bc →B*, 这是研究该半轻衰变过程首个统一的理论。接触相互作用模型的优势在于代数简洁、参数少，可对南部-戈德斯通模式的系统提供很好的描述。通过对比发现，接触相互作用模型的结果与实验或其它可靠理论相符，因此有望为赝标到矢量半轻衰变的分支比提供很好的预言。同时，我们也计算了跃迁形状因子，作为强子内部结构的体现，它反映了自然界两大质量产生方式——希格斯机制和演生机制的相互影响，为演生质量的研究提供了重要的途径。

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 287

双重子系统双 beta 衰变的格点计算

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我们报告的主要内容是利用格点 QCD 非微扰地计算含有弱衰变的双重子矩阵元的方法以及初步结果，主要包括质子。近年来无中微子双 beta 衰变实验备受关注，虽然实验观测大多使用较重的原子核，直接使用格点 QCD 计算并不现实，但我们计算出的相关双重子弱衰变矩阵元能够以有效场论为桥梁为核多体计算提供 2 体算符的输入，而这也是目前核多体第一性原理计算中的主要误差来源之一。目前已发表的相关结果比较少，NPLQCD 合作组在 2017 年给出了双质子融合和双中微子双 beta 衰变的结果，而无中微子双 beta 衰变方面目前只有 pi 介子的计算结果。我们目前的得到的g_A 以及双质子融合矩阵元、双中微子双 beta 衰变矩阵元的初步结果与前人工作相符，无中微子双 beta 衰变矩阵元有待进一步研究。

Parallel Session VIII (1)：TeV and BSM Physics / 288

低能和高能实验对 W' 诱发的荷电非标准中微子相互作用的限制

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许多新物理模型预言了荷电规范玻色子 W' 的存在，其会引起荷电非标准中微子相互作用（CC NSI）。我们首先关注低能实验数据对新规范玻色子 W' 引起的 CC NSI 的约束。其次在简化的 W' 模型中分别从微扰幺正性和 W' 衰变两个方面考虑 CC NSI 参数的理论约束，通过蒙特卡洛模拟，研究了大型强子对撞机的 pp→lν 过程和电子-质子对撞机的 ep→νej 过程对 CC NSI 参数的预期约束。我们发现对撞机实验可以为研究 NSI 效应提供令人兴奋的前景，这也将有利于在对撞机中探索超出标准模型的新物理理论。

Parallel Session VI (3)：Heavy Ion Physics / 290

EM field produced in high-energy small collision systems within charge density models of nucleons

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Recent experiments show that \Delta\gamma, an observable designed to detect the chiral magnetic effect (CME), in small collision systems (p+A) is similar to that in heavy ion collisions (A+A). This introduces a challenge to the existence of the CME because it is believed that no azimuthal correlation exists between the orientation of the magnetic field (\phi_B) and participant plane (\phi_2) in small collision systems. In this work, we introduce three charge density models to describe the inner charge distributions of protons and neutrons and calculate the electric and magnetic fields produced in small p+A
collisions at both RHIC and LHC energies. Our results show that the contribution of

the single projectile proton is the main contributor to the magnetic field after averaging over all participants. The azimuthal correlation between \phi_B and \phi_2 is small but not vanished. Additionally, owing to the large fluctuation in field strength, the magnetic-field contribution to \Delta\gamma may be large.

Parallel Session VI (2)：Hadron and Flavor Physics / 291

B(s), D(s) to light tensor meson form factors via LCSR in HQEFT with applications to semileptonic decays

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In the present work, the form factors of $B_{(s)}, D_{(s)}$ to
light P-wave tensor mesons ($a_2(1320)$, $K_2^*(1430)$, $f_2(1270)$,
$f_2'(1525)$) are calculated via the light cone sum rules
(LCSR) in the framework of heavy quark effective field theory
(HQEFT). Firstly, the expressions of form factors in
terms of the light cone distribution amplitudes (DAs) of tensor
mesons are derived via the LCSR at the leading order of heavy quark
expansion. It is found that the penguin type form factors can be obtained directly from the corresponding
semileptonic ones, which is similar to the case of S-wave mesons.
Considering the light tensor meson DAs to twist-3, we give the
numerical results of form factors systematically. As applications, we investigate the branching ratios,
longitudinal polarization fractions and forward-backward asymmetries of relevant semileptonic decays induced by charged current and
flavor changing neutral current (FCNC) separately. Our results may be
tested by more precise experiments in the future.

Parallel Session VIII (2)：Hadron and Flavor Physics / 296

New look at the spectrum of low-lying mesons

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The spectrum of mesons with mass less-than 2 GeV, especially those with strangeness, is poorly understood - both experimentally and theoretically. We address this issue by employing a novel method for constructing a kernel for the meson bound-state problem. The scheme produces a closed-form kernel that is symmetry-consistent (discrete and continuous) with the gap equation defined by any admissible gluon-quark vertex. Applicable even when the diagrammatic content of that vertex is unknown, the scheme can foster new synergies between continuum and lattice approaches to strong interactions. The framework is illustrated by showing that the presence of a dressed-quark anomalous magnetic moment in the gluon-quark vertex, an emergent feature of strong interactions, can remedy many defects of widely used meson bound-state kernels, including the mass splittings

between vector and axial-vector mesons and the level ordering of pseudoscalar and vector meson radial excitations. The new insights may be exploited by the spectroscopy programme in the AMBER project at CERN.

Parallel Session II (5)：Particle Detector Technology / 298

Monopix：高抗辐射、高速单片集成式 CMOS 像素探测器

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全耗尽型单片集成 CMOS 像素探测器相比于传统的 CMOS 像素探测器能够实现更快的电荷收集，从而大幅提升探测器的时间分辨能力以及强辐射后的电荷收集效率。Monopix 探测器芯片主要是面向未来强子对撞实验的强辐射环境而研发的全耗尽型单片集成 CMOS 像素探测器芯片，包含了 LF-Monopix 与 TJ-Monopix 两个系列，二者分别通过两种不同的技术路线实现了探测器敏感层的全耗尽，目前均已完成接近全尺寸的原型片设计制造以及主要性能指标的测试。

LF-Monopix 系列芯片采用了高阻 P 型硅衬底（>2 kΩ.cm）的 150nm 商用 CMOS 工艺设计制造，配合高压偏置（> 300 V）可以轻易达到超过 200μm 的全耗尽探测敏感层。读出电路部分采用了高速读出构架，能够达到 25 ns 的时间分辨以及应对 100MHz/cm^2 以上的粒子击中率。束流测试显示该探测器芯片在经过 1×10^15 neq/cm^2 的辐照后仍可以实现 99% 的总探测效率，其中接近 97% 的粒子可以在 25ns 的时间窗内得到探测与前端电学信号处理。LF-Monopix 的传感器部分已经证实在经过 1×10^16 neq/cm^2 的辐照后仍能维持 99% 的探测效率。此外，芯片在经过 100Mrad 的 X 射线辐射后电学性能没有出现明显衰减。

TJ-Monopix 采用 180nm 商用 CMOS 工艺，其在传统 CMOS 像素工艺的基础上进行了改进，使得探测器在保持了小传感器电容（< 5fF）的基础上实现了全耗尽的探测层。小的传感器电容保证了前放电路的低功耗以及低噪声。读出电路的设计针对 25ns 的时间分辨进行优化设计，并且像素阵列读出采用了与 LF-Monopix 相同的数字构架。实验室测量得到芯片噪声水平为 15 −20 e-，阈值的不均匀性为 ~10 e-。束流测试表明探测效率达到 ~99%。

Summary:

Monopix 系列芯片通过传感器部分的全耗尽设计以及高速读出电路构架实现了传统 CMOS 像素探测器无法达到的高抗辐射与高速性能。目标抗辐射能力为 1×10^15 neq/cm^2 的 NIEL 与 100Mrad 的 TID，同时能够以 25ns 的精度分辨粒子的到达时间。报告将对 Monopix 系列的最新进展进行介绍。

Parallel Session IX (5)：Particle Detector Technology / 299

Effect of Carbon co-implantation on radiation hardness of LGAD

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The Low Gain Avalanche Detectors (LGAD) are silicon sensors with a state-of-the-art timing performance specifically tailored for the High Granularity Timing Detector (HGTD) programme in the ATLAS detector to answer the unprecedentedly complex pile-up in the High-Luminosity Large Hadron Collider (HL-LHC). In virtue of thin epitaxial layer and moderate internal gain, the time resolution of IHEP-IMEv2 LGADs reaches 35 ps before irradiation. A major challenge to these sensors is to maintain time resolution at low bias after withstanding 1 MeV neutron equivalent fluence up to 2.5×10^{15} $n_{eq}cm^{-2}$ during their operating life in HGTD , given that high energy particles passing through the sensor deactivate gain layer acceptors (acceptor removal), leading to a deterioration of time performance.
IHEP-IMEv2 LGADs are designed aiming at improving device radiation hardness as well as discovering the dependence of c factor values to carbon distribution in the critical region of devices. 12 designs vary in carbon implantation dose and carbon thermal load are included in this version. Carbon distributions in critical region of LGADs are analyzed in detail based on SIMS. In an effort to explain the mechanism of implanted carbon to alleviate acceptor removal induced by radiation, the acceptor removal coefficients (c factors) of LGADs are modeled based on SIMS data. The modeled values are in good agreement with measurements. This model is povital to the design of next version IHEP LGAD and will help bring to light the acceptor removal mechanism.

Parallel Session III (5)：Particle Detector Technology / 300

Cherenkov PID detector for super tau-cham facility

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The Super tau-Charm facility (STCF) project, which is an electron-positron collider at the center-of-mass 2~7 GeV, is under exploring and will play crucial role in the high density frontier of elementary particle physics. The PID detector in STCF serves an excellent PID capability for charged hadrons. The effective PID is required to reach a statistical separation power better than 3 sigma to fulfill the desired physics goals. In the conceptual design, Cherenkov detector is one suitable technology for PID. In this report the two kinds of Cherenkov detector is described: Ring Image Cherenkov detector for the barrel, and the Dirt-like TOF for the end-cap.

Parallel Session IX (1)：TeV and BSM Physics / 301

A formal notion of genericity and its application to supersymmetric Wess-Zumino models

作者： Zheng Sun[1]

合作者： Greg Yang [2]; James Brister [1]

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We establish a formal notion of genericity, expressed as an equality for derivatives of the generic property function to parameters of the models. We apply this notion to generic Wess-Zumino models with R-symmetries, where we show that the superpotential vanishes term-by-term at a supersymmetric vacuum. This work is published in JHEP 12 (2021) 199.

Summary:

Parallel Session II (5)：Particle Detector Technology / 303

Development of SOI pixel sensor for the CEPC vertex detector

作者： Yunpeng LU[1]

合作者： Hongyu ZHANG [2]; Mingyi Dong [3]; Qun OUYANG [3]; ZHOU Yang ; 佳周 [4]; 静董 [4]

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高空间分辨率的像素传感器是未来环形正负电子对撞机 CEPC 顶点探测器的核心技术。为了在 r(phi) 平面达到 5 微米的次级顶点重建精度（impact parameter resolution），要求像素传感器本身的空间分辨率达到 3 微米。在低功耗和快速读出的设计约束下，采用 Binary 读出的像素 pitch 需要缩小到 16~18 微米才有可能满足高空间分辨率的要求。但是每个像素的模拟前端和数字逻辑电路所需的版图面积限制了像素 pitch 从目前主流的 25~30 微米进一步缩小。最新的 3D-SOI 技术在常规 200nm SOI 像素传感器的基础上，增加了垂直堆叠的 upper 电路层和高密度微球（micro-bump）阵列连接。这为保持像素电路功能的前提下，缩小像素 pitch 提供了技术条件。
本报告从 CEPC 顶点探测器的设计挑战出发，介绍主要的设计指标对像素传感器设计方案的约束，并讨论空间分辨率与像素 pitch 的依赖关系。结合 CPV(Compact Pixel for Vertex) 系列像素芯片的研发工作，给出高空间分辨率的实现方法，尤其是采用 3D-SOI 设计的 CPV-4 芯片整体方案。目前该芯片的 Lower tier 和 Upper tier 已经分别完成了功能验证，正在进行 3D 集成的后道工艺处理。这项工作为实现极高空间分辨的像素传感器提供了一种可行的技术路线。相比于采用新一代 65 nm 或更小 CMOS 工艺，通过缩小晶体管尺寸来缩小像素 pitch 的另一种技术路线，具有耗尽层厚，信噪比高的优点，有望满足 CEPC 顶点探测器高空间分辨率，低功耗和快速读出的综合指标要求。

Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 305

AMS 实验伽马射线顶点重建算法与伽马射线极化研究

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伽马射线极化是伽马天文研究的前沿领域，对于认知伽马射线源的产生机制以及寻找轴子、暗光子等新物理具有重要意义。AMS 实验可以通过光子在探测器中转换为正负电子对的过程高精度的重建伽马射线的能量、方向，顶点重建算法是该研究的基础。本报告将介绍基于 Cellular Automaton 网络的伽马宇宙线事例顶点重建算法，分析该算法对光子重建效率的提升，以及在 200MeV 至 TeV 能量范围内 AMS 伽马射线极化的研究进展。

Parallel Session II (5)：Particle Detector Technology / 306

NTD-Ge thermistor fabrication for cryogenic bolometer application

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Neutron Transmutation Doped Germanium have a very uniform distribution of dopants and can work as thermistor at ultra-low (10 mK) temperature when using Bolometric detection technique. NTD-Ge have played a critical role in many rare events searching experiments. We produced a batch of NTD-Ge samples by thermal neutron irradiation and fabricated several NTD-Ge thermistors. We did some fundamental studies such as annealing of radiation defects produced by fast reactor neutrons and carrier concentration using variable temperature Hall-effect to determine the properties of NTD-Ge. The resistance-temperature relationship measurements are to be carried out to characterize the NTD-Ge thermistor in the near future.

Parallel Session V (2)：Hadron and Flavor Physics / 308

Spatial extent of $\Delta(1232)$ with $\pi^0\pi^0$ momentum correlations using the high-resolution EM calorimeter BGOegg

作者： Qinghua He[1]

[1] *Nanjing University of Aeronautics and Astronautics*

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Measuring the properties of hadrons in the non-perturbative QCD energy region is one of the powerful tools to understand the hadron structure and strong interaction. We propose to measure the spatial extent of intermediate baryon resonances and of hadron reaction volume in the non-perturbative QCD energy region. A new method is developed to measure the spatial extent of the $\Delta(1232)$ resonance involved in the sequential decay process $p\to^0\Delta^+\to^{00}p$. The information on the size is given by investigating the Bose-Einstein correlation of these two π^0s. The experiment is carried out at LEPS2 beam line in Spring-8 with the electromagnetic calorimeter BGOegg of nearly 4π coverage which enables an unprecedented high-resolution measurement, providing precise data for $\pi^0\pi^0$ relative momenta. In addition, s-channel resonance contributions coupling to $\pi^0\pi^0p$ are weak in the photon-beam energy region of 1.3-2.4 GeV, opening the possibility of selecting a clean sample for examining $\pi^0\pi^0$ correlations.

Summary:

Parallel Session I (2)：Hadron and Flavor Physics / 309

LHCb 上奇特态的产生研究

作者： 兢一徐 [1]

[1] *University of Chinese Academy of Sciences*

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我们将报告 LHCb 实验在奇特强子态产生测量方面的结果。

Parallel Session V (2)：Hadron and Flavor Physics / 310

LHCb 上双重味重子研究

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我们将报告 LHCb 实验在双重味重子方面的结果。

Summary:

Parallel Session III (2)：Hadron and Flavor Physics / 311

Searches for rare decays and new physics at LHCb

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We will report selected recent results of new physics searches at LHCb via the study of b-hadrons decays that are rare or forbidden in the standard model of particle physics.

Parallel Session V (2)：Hadron and Flavor Physics / 312

Study of the B -> Lc Lcbar K decay at LHCb

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A charmed baryon with strange quark, Xic(2930), was found in the B- -> Lc Lcbar K- decay at B-factories, yet the study of Lc K- pairs produced directly in pp collisions at LHCb finds two baryon states, Xic(2923) and Xic(2939), at this mass region. These two states are confirmed by a recent study of B- -> Lc Lcbar K- at LHCb using pp collision data at 13 TeV. Other features in the Lc K- mass spectrum are also studied. The relative branching fraction of the channel is reported with respect to B -> DDK

Parallel Session I (2)：Hadron and Flavor Physics / 313

Search for pentaquarks in B-meson decays at LHCb

作者： Jianyu ZhangN[one]

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The first discovery of pentaquarks at LHCb in 2015, opens new window to study QCD. The LHCb experiment has the large dataset and excellent detector performance in such searches. In this talk, the latest results on pentaquark study in B-meson decays from LHCb will be discussed.

Parallel Session I (2)：Hadron and Flavor Physics / 314

Observation of a resonant structure near the Ds+Ds- threshold at LHCb

作者： Hongrong Qi[1]

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A near-threshold peaking structure, dubbed X(3960), is observed in the Ds+Ds- mass spectrum with significance greater than 12 standard deviations, using proton-proton collision data collected with the LHCb detector at centre-of-mass energies of 7, 8 and 13 TeV. Its quantum numbers is measured to be Jˆ{PC}=0ˆ{++} with the amplitude analysis. It may be a candidate with the quark content: c cbar s sbar candidate.

Parallel Session II (2)：Hadron and Flavor Physics / 315

Observation of a double charged tetraquark state and its neutral partner at LHCb

作者： Ruiting Ma[1]

[1] *University of Chinese Academy of Sciences (UCAS)*

The discoveries of meson-like exotic states have been attracting huge interest from the hadron physics community. A doubly charged tetraquark, T_csbarˆa(2900)ˆ++, and its neutral partner, T_csbarˆa(2900)ˆ0, are observed in the combined anplitude analysis of B+ -> D- Ds+ pi+ and B0 -> D0bar Ds+ pi- decays, based on the totally 9 fbˆ-1 pp collision datasets collected by LHCb Collaboration. They are the manifestly tetraquark candidates, with the minimum quark contents [c\bar{s}u\bar{d}] and [c\bar{s}\bar{u}d]. It's the first observation of a doubly charged meson and its isospin partner, which belong to the same isospin triplet. The masses, widths and spin-parity numbers of new exotic resonances are measured in the analysis. The measured masses of them are similar with the X0(2900) ([cs\bar{u}\bar{d}]) previously observed in LHCb, but the width and flavor contents are different.

Parallel Session X(1)：TeV and BSM Physics / 316

Search for scalar leptoquarks in the $b\tau\tau$ final state in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

作者： 瀚非叶 N[one]

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A search for singly-produced scalar leptoquarks decaying to $b\tau$ in proton-proton collisions is performed using Run 2 data from LHC corresponding to an integrated luminosity of 139 fb^{-1} at $\sqrt{s}$ =13 TeV recorded by the ATLAS detector. The signal benchmark model considered is a scalar leptoquark with an electric charge of 4/3e and quantum numbers $3B + L = -2$, which decays exclusively into a b-quark and a τ-lepton. The mass range searched is from 0.4 TeV to 2.5 TeV. No significant excess above the Standard Model prediction is observed, and 95% confidence-level upper limits are provided on the production cross-section times branching fraction of leptoquarks decaying to $b\tau$. Considering both single and pair leptoquark production processes, under the assumption of exclusive decays of scalar leptoquarks to $b\tau b\tau$, leptoquark masses below 1.26 TeV, 1.30 TeV and 1.41 TeV are excluded for a for a Yukawa coupling to b-quark and τ-lepton of 1.0, 1.7 and 2.5.

Parallel Session VII (3)：Heavy Ion Physics / 317

Probing QGP Properties with Upsilons at the sPHENIX Experiment

作者： Weihu Ma[1]

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The upcoming sPHENIX experiment is the next generation of large acceptance detector at RHIC whose scientific goals center on probing the strongly interacting Quark-Gluon Plasma (QGP) with jets, heavy flavor tagged jets, and Upsilon production. Upsilon is produced by hard scattering in the early times of a relativistic heavy-ion collision, thus experiencing the entire evolution of the QGP. It has a distinct advantage over charmonium measurements as a probe of QGP. I will present an overview of the sPHENIX Upsilon measurement program with an emphasis on sPHENIX electron identification capability. In particular, the EMCal detector is an essential subsystem for Upsilon measurements via its di-electron decay. Combining EMCal with the upstream TPC track and the downstream inner HCal detectors, sPHENIX can achieve a 90% eID efficiency with ˜100:1 hadron rejection. High precision measurements of Upsilon production with sufficient accuracy for clear separation of the Y(1S, 2S, 3S) states is a key deliverable of the sPHENIX physics program. I will also describe the construction effort of the Chinese sPHENIX Consortium contribution sPHENIX EMCal blocks covering the pseudo-rapidity region of 0.8-1.1. The Chinese contribution greatly enhanced the physics capability of sPHENIX for jets and Upsilon measurements.

Parallel Session IX (5)：Particle Detector Technology / 318

IHEP-IME LGAD 传感器抗辐照特性研究

作者： Mei Zhao[1]; Xuewei Jia[2]

合作者： Joao Guimaraes Costa ; Mengzhao LI [3]; Yuan Feng [3]; 梁志均 LIANG Zhijun

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ATLAS 高粒度高时间分辨探测器 (HGTD) 项目拟通过采用时间分辨特性优于 35ps 的低增益雪崩探测器作为核心探测器件，以提供轨道的精确时间测量，进而减少 HL-LHC 探测器中的粒子堆积效应。中国科学院高能物理研究所（IHEP）一直在与中国科学院微电子研究所（IME）合作开发 LGAD 传感器（IHEP-IME）。到目前为止，已经生产了三个版本的 IHEP-IME LGAD 传感器。第一版 IHEP-IMEv1 器件很好地实现了满足项目时间分辨性能的器件的制备。第二版 IHEP-IMEv2 器件，在第一版基础上优化了器件制备工艺与并通过掺碳提高了器件辐照特性。

具有不同碳剂量的 IHEP-IMEv2 传感器，具有优良的抗辐照特性，显著改善了器件辐照后硼失效的问题。15x15 像素阵列器件在辐照前后展示了良好的一致性。本次报告将具体展示具有不同碳注入条件的器件在辐照前后的性能测试结果，分析碳注入工艺对器件辐照特性的影响。低温 beta 测试结果表明，经过 2.5e15 neq/cm2 辐照后 IHEP-IMEv2 器件在 400 V 以下可采集 4 fC 电荷，时间分辨率优于 50 ps，满足 HGTD 项目要求。也将对 IHEP-IMEv3 器件的设计情况与测试结果进行报告。

Parallel Session VIII (5)：Particle Detector Technology / 319

面向同步辐射光源图像的智能无损压缩方法

作者： FU ShiyuanN[one]

合作者： Lu WANG Lu [1]; Yaodong CHENG [1]; 宇高 [2]; 张敏行

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在建的同步辐射光源装置预计每年将产生高达数百 PB 的海量实验数据，其中占比最高的是硬 X 射线成像实验线站产生的图像数据。庞大的数据量为存储和传输带来极大压力，而压缩是降低数据量的有效手段，同时，为保证科学数据的完整性，压缩过程不可造成信息损失。通用图像无损压缩方法对该类图像压缩效果不佳，因此针对光源图像特性，提出一种面向同步辐射光源图像的智能无损压缩方法。首先，通过分区量化方法自适应确定像素值量化参数，提取对压缩结果影响较大的关键数据，有效降低像素值所占比特位数，同时设置占位符保证量化过程无损；其次，设计基于 CNN 的 C-zip 网络，作为高效的智能概率预测器，结合合理的训练及预测方法，有效缓解模型存储带来的数据膨胀问题；最后，提出概率距离的概念，进一步挖掘深度学习输出中有益于数据压缩的信息，提高编码并行度。基于上海同步辐射光源图像的测试表明，相较于通用图像无损压缩方法 PNG/JPEG2000/JPEG-LS/FLIF，本算法可进一步将压缩比提升 0.23-0.58。

Parallel Session IX (5)：Particle Detector Technology / 327

Check on the features of potted 20-inch PMTs with 1F3 electronics prototype at Pan-Asia

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The Jiangmen underground neutrino observatory (JUNO) is a neutrino project with a 20-kton liquid scintillator detector located at 700-m underground. The large 20-inch PMTs are one of the crucial components of the JUNO experiment aiming to precision neutrino measurements with better than 3% energy resolution at 1MeV. The excellent energy resolution and a large fiducial volume provide many exciting opportunities for addressing important topics in neutrino and astro-particle physics. With the container #D at JUNO Pan-Asia PMT testing and potting station, the features of waterproof potted 20-inch PMTs were measured with JUNO 1F3 electronics prototype in waveform and charge, which are valuable for better understanding on the performance of the waterproof potted PMTs and the JUNO 1F3 electronics. In this paper, basic features of JUNO 1F3 electronics prototype run at Pan-Asia will be introduced, followed by an analysis of the waterproof potted 20-inch PMTs and a comparison with the results from commercial electronics used by the container #A and #B.

Parallel Session VIII (5)：Particle Detector Technology / 328

面向高能物理数据处理的可计算存储系统设计与实现

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随着高能物理实验装置复杂度和规模的不断扩大，实验数据的存量和增量均逐年增加。因此，高能物理实验对数据的处理能力和存储能力提出了新的挑战。高能物理数据处理普遍采用“存算分离”的计算模式，数据处理时需要在计算节点和存储节点间频繁搬运，占用大量的访存带宽和网络带宽。当系统中的计算作业达到一定规模时，便会遇到“内存墙”问题，以及各种网络问题、文件系统故障等，使整个计算系统处于不稳定状态。
可计算存储技术尝试将计算单元的部分任务卸载到存储单元，以减少数据移动，提升系统整体的处理效率。还可通过异构计算部件来补充存储单元的计算能力，达到计算加速的目的。
本文提出将可计算存储技术应用到高能物理数据处理中，并设计实现了相应的可计算存储服务器。该服务器以 CPU 为核心，通过 PCIe 总线挂载若干硬盘用于数据存储，以及 FPGA 芯片用于计算加速。利用 FPGA 可定制性强、并行度高的特点，对高能物理领域中部分常见的计算密集型任务和 I/O 密集型任务进行加速，只将存储单元的计算结果反馈给计算单元，从而减少或不进行节点间的数据移动。通过 FPGA 与硬盘之间的“数据零拷贝”，减少了计算加速时服务器内部的数据搬运。利用 FPGA 动态配置功能，可实现应用的快速切换。根据应用的特点，本系统在算法、应用、服务三个层次提供可计算存储服务，可明显缓解高能物理数据处理过程中由大量数据搬运造成的 I/O 瓶颈问题。在提升计算效率的同时，也增强了系统运行的稳定性。

Parallel Session IX (5)：Particle Detector Technology / 329

”GRAND” 数据获取电子学板的测试研究

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[1] *purple mountain observatory*

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” GRAND“全称为“Gaint Radio Array for neutrino”（巨型中微子探测阵列），旨在研究超高能宇宙线的起源、加速与传播机制，在预计 2030 年建成后，将实现对于能量在 10^17eV 及以上的中微子的成功探测，开创中微子天文学的新时代。
其探测单元基本组成为：天线、低噪声放大器、Wifi、太阳能供电装置、DAQ 板，DAQ 板的作用在于对天线的输出信号进行电子学处理，同时对电源状态、温度、压强等诸多变量进行监测，将采集的数据通过 Wifi 传输至中心站，因此 DAQ 板对宇宙线信号的探测起着举足轻重的作用，为了保证探测的精度与效率，需要对 DAQ 板的基本功能与性能进行测试，其中，功能测试包括：信号采集与传输、FPGA 触发算法、FPGA 滤波算法等，性能测试包括：ADC 性能、系统增益与相位、GPS 时间性能等。
本次展示内容主要为对 DAQ 板的测试结果以及对 DAQ 板进一步改进完善的意见。

Parallel Session X (2)：Hadron and Flavor Physics - Posters / 330

质子电极化率的格点 QCD 计算

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核子的电磁极化率是描述其性质与内部结构的重要参数。其反映了核子对电磁场的二阶响应。核子的极化率可以从其康普顿散射过程$\gamma N \to \gamma N$ 中提取。本工作中，我们通过在格点上构造核子的四点关联函数来极端其康普顿散射矩阵元。之后，我们会展示质子的电极化率是如何从格点数据中提取出来的。

Parallel Session VI (2)：Hadron and Flavor Physics / 331

Pion 介子分布函数

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在量子色动力学框架下存在一个有效的跑动耦合常数，它制约着强子分布函数随能标的演化，并在所有的阶次上保持成立。由此，我们指出在强相互作用系统中存在一个独特的强子能标，在这个能标下，强子动量完全由价夸克携带，并且给出在该能标下分布函数相应 Mellin 矩的上下限。通过分析当前格点 QCD 关于 moments 的计算结果，发现格点 QCD 均自洽落在该上下限内，并由此可以参数无关的预言 Pion 介子中价夸克、胶子及海夸克的分布函数。

Parallel Session IX (3)：Heavy Ion Physics / 332

Spin alignment of vector mesons in heavy-ion collisions

作者： Xin-Li Sheng[1]

合作者： Qun WANG [2]; Xin-Nian Wang [3]

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We present a relativistic spin Boltzmann equation (SBE) for spin dynamics of vector mesons based on Kadanoff-Baym equations. Using SBE and an effective quark-meson model, we calculate ρ_{00} (the 00-element of the spin density matrix) for ϕ mesons formed by the coalescence of s and $\overline{s}$ quarks which are assumed to be polarized by the vorticity and ϕ fields. We show that the contributions to ρ_{00} from the vorticity and ϕ fields all appear as local correlation between strong force fields of the same kinds and same components. This indicates that fluctuations of strong force fields play an important role in ρ_{00}, which can be formulated and extracted in relativistic quantum transport theory. Our results on the colliding energy, transverse momentum and centrality dependence of ρ_{00} are in good agreement with recent STAR data for ϕ mesons.

Parallel Session VII (5)：Particle Detector Technology / 333

SiPM 阵列替代 PMT 用于闪烁体读出应用研究

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近年来，硅光电倍增器（SiPM）作为光电倍增管（PMT）的替代用于闪烁体读出得到广泛应用。SiPM 具有和 PMT 相当的增益，但具有高量子效率、低偏置电压、小体积、高强度和磁场兼容性等优点，缺点是暗噪声大、动态范围小。由于单片 SiPM 面积较小（目前最大 6mmx6mm），用于英寸尺度的闪烁晶体读出时需要采用多个 SiPM 组成阵列，SiPM 的暗噪声以及大电容是影响测量的关键因素。在本文中，采用 SiPM 阵列作为闪烁体读出，针对多种不同的晶体（NaI(Tl)、SrI2、CLYC、EJ-276、EJ-301、NaIL 等）用于伽马能谱测量以及伽马/中子粒子甄别等应用，结合优化设计的电路，对能量分辨率、线性度、脉冲波形甄别性能等开展了系统研究，并与 PMT 的测量结果进行比较。实验结果表明，SiPM 阵列用于闪烁体读出，在能量分辨率和脉冲波形辨别上可以实现和 PMT 读出相当的性能，为小型化仪器设计提供了重要参考。

Summary:

Parallel Session VI (3)：Heavy Ion Physics / 335

Impact Parameter Dependence of Photon-Photon Scatterings in Heavy-Ion Collisions

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The Lorentz boosted electromagnetic fields shrouding relativistic heavy ions can be treated as a flux of linearly polarized quasi-real photons. Therefore, ions can interact when their impact parameter is greater than twice the nuclear radius, the so-called ultraperipheral collisions (UPCs), via photon-photon process. This photon-photon process has also been observed in hadronic heavy-ion collisions. The intriguing thing is that the mean transverse momentum (p_T) of lepton pairs from photon-photon scatterings in hadronic collisions is found to be larger than that from UPCs. This phenomenon sparked an intense discussion in the field that whether the observed broadening is caused by final-state electromagnetic modifications of lepton pairs in a Quark Gluon Plasma (QGP) medium or p_T hardening of initial-state photons as the impact parameter decreases toward central hadronic collisions.

In this talk, I will firstly summarize the achievements of photon-photon interactions based on experimental results in hadronic collisions. Then a novel experimental tool for controlling the impact parameter in UPCs will be presented. This novel tool helps to unambiguously study the role of initial photon p_T in the observed broadening in hadronic collisions. Finally, I will discuss the roadmap and opportunities of using photon-photon interactions to quantitatively probe the electromagnetic properties of QGP medium with precise heavy-ion data in future.

Parallel Session IX (2)：Hadron and Flavor Physics / 336

格点计算稀有 K 介子衰变的新方案

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K 物理，尤其是稀有 K 介子衰变，因为其实验上有相对干净的分支比、理论上涉及到味道改变中性流和 CP 破坏等对新物理十分敏感的物理过程，而十分适合于精确检验标准模型和探寻标准模型之外的新物理。为了达到这个目标，我们需要解决目前主要的理论不确定度的来源：与低能非微扰 QCD 相关的长程贡献计算。近年来，格点场论方法从第一性原理 QCD 出发，在稀有 K 介子衰变的长程贡献计算上扮演越来越重要的角色。在本工作中，我们提出一套创新的格点计算方案“无穷体积轻子方法”，系统地回答了如何计算末态较为复杂的 K 介子衰变过程的问题，并解决了其中涉及到的各种系统误差。该方案可以广泛地运用于各类稀有衰变过程，从而拓展了格点场论能处理的问题的范围。作为新方法的探索性尝试，我们以 K 的四轻子稀有衰变过程为例进行研究，得到了可以和实验与手征微扰论相比较的计算结果，验证了该方案的有效性。

Summary:

Parallel Session III (5)：Particle Detector Technology / 338

The Potential to Probe Solar Neutrino Physics with LiCl Water Solution

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Lithium chloride water solution is a good option for solar neutrino detection. The ν_e charged-current (CC) interaction cross-section on ^{7}Li is evaluated with new B(GT) experimental measurements. The total CC interaction cross-section weighted by the solar ^{8}B electron neutrino spectrum is $3.759 \times 10^{-42}\ \mathrm{cm}^2$, which is about 60 times that of the neutrino-electron elastic scattering process. The final state effective kinetic energy after the CC interaction on ^{7}Li directly reflects the neutrino energy, which stands in sharp contrast to the plateau structure of recoil electrons of the elastic scattering. With the high solubility of LiCl of $74.5\ \mathrm{g}/100\ \mathrm{g}$ water at $10^{\circ}\mathrm{C}$ and the high natural abundance of 92.41%, the molarity of ^{7}Li in water can reach $11\mathrm{mol/L}$ for safe operation at room temperature. The CC event rate of ν_e on ^{7}Li in the LiCl water solution is comparable to that of neutrino-electron elastic scattering. In addition, the ν_e CC interaction with the contained ^{37}Cl also contributes a few percent of the total CC event rate. The contained ^{35}Cl and ^{6}Li also make a delay-coincidence detection for electron antineutrinos possible. The recrystallization method is found to be applicable for LiCl sample purification. The measured attenuation length of 11 ± 1 m at $430\mathrm{nm}$ shows that the LiCl solution is practicable for a $10-\mathrm{m}$ diameter detector for solar neutrino detection. Clear advantages are found in studying the upturn effect of solar neutrino oscillation, light sterile neutrinos, and Earth matter effect. The sensitivities in discovering solar neutrino upturn and light sterile neutrinos are shown. More details of the work can be found in arxiv:2203.01860.

Summary:

Parallel Session IX (5)：Particle Detector Technology / 339

Automatic High-Granularity Timing Detector Module Assembly with Gantry System

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The large increase in pileup interactions is one of the main experimental challenges for the HL-LHC project. The High Granularity Time Detector (HGTD), based on low gain avalanche detector technology, is therefore proposed to reduce the pileup contribution at HL-LHC. The basic component of the HGTD detector is the detector module, which consists of one module flex and two bare modules. The module flex is attached to the two bare modules with an adhesive with 100um placement precision and 50um adhesive thickness requirement. The HGTD detector consists of 8032 such modules, about 3000 of which will be assembled at IHEP. In order to assemble such a huge amount of modules at a reasonable rate, a high-precision robotic pick-and-place system, consisting of an excellent motion platform with less than 1 um repositioning resolution, Keyence intelligent vision system, Nordson glue dispenser, and flexible piping system, was built at IHEP clean room. A lot of custom tools and one C++ Qt program to control the gantry system were also developed for fully automatic module assembly. Several digital modules, consisting of two ASICs and one module flex, and real modules, consisting of two bare modules and one module flex, were assembled with this gantry system and those custom toolings. The wire bonding was performed very well for both the digital modules and real modules. In addition, some typical metrology results for those modules are also within the specification. The gantry system, assembly details, and the performance result of the assembled modules will be shown in the poster.

Parallel Session I (1)：TeV and BSM Physics / 340

How arbitrary are perturbative calculations of the electroweak phase transition?

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We investigate the extent to which perturbative calculations of the electroweak phase transition are arbitrary and uncertain, owing to their gauge, renormalization scale and scheme dependence, as well as treatments of the Goldstone catastrophe and daisy diagrams. Using the complete parameter space of the Standard Model extended by a real scalar singlet with a Z2 symmetry as a test, we explore the properties of the electroweak phase transition in general Rxi and covariant gauges, OS and MSbar renormalization schemes, and common treatments of the Goldstone catastrophe and daisy diagrams. Reassuringly, we find that different renormalization schemes and different treatments of the Goldstone catastrophe and daisy diagrams typically lead to only small changes in predictions for the critical temperature and strength of the phase transition. On the other hand, the gauge and renormalization scale dependence may be significant, and often impact the existence of the phase transition altogether.

Parallel Session VI (3)：Heavy Ion Physics / 341

Probing the electromagnetic field with heavy quarks and leptons from the decay of Z0 in ultrarelativistic heavy ion collisions

作者： Yifeng Sun[1]

合作者： Salvatore Plumari [2]; Vincenzo Greco [3]; Xin-Nian Wang [4]

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[3] *INFN-LNS*

[4] *Central China Normal University/Lawrence Berkeley National Laboratory*

Ultra-relativistic heavy ion collisions are expected to generate a huge electromagnetic (e.m.) field that is envisaged to induce several effects on hot QCD matter including the possibility of local parity and local parity and charge conjugation symmetry violations. A direct signature of such e.m. fields and a first quantitative measurement of its strength and lifetime are still missing.

We will discuss why it is expected to generate a splitting of the directed flow of charged particles and anti-particles, which allow to constraint the e.m. field and can be considered also as a possible probe of the formation of the quark-gluon plasma phase. Furthermore, we found that the v1 splitting depends critically on the time evolution of the magnetic field. Based on this study, we finally discuss why the measurement of leptons from Z0 decay and its correlation to the charmed mesons are better in probing e.m. fields and thus opening a new way to constrain the EM field.

The second topic we want to discuss is the modification of the Z0 leptonic invariant mass in the presence of EM fields. We found that EM fields will decrease the Z0 leptonic invariant mass and increase the width of it by few hundred MeV if the large of D0 and anti-D0 measured by ALICE is all due to EM fields. Moreover, both the invariant mass and its width are found to approximately depend on the integral of magnetic field quadratically. This provides an independent way to constrain the EM field.

1 Y. Sun, V. Greco and X.N. Wang, Phys. Lett. B 827, 136962 (2022).

2 Y. Sun, S. Plumari and V. Greco, Phys. Lett. B 816, 136271 (2021).

3 Y. Sun, V. Greco and S. Plumari, Eur. Phys. J. Plus 136, 726 (2021).

[4] S. K. Das, S. Plumari, S. Chatterjee, J. Alam, F. Scardina and V. Greco, Phys. Lett. B 768, 260-264 (2017).

Parallel Session V (5)：Particle Detector Technology / 342

基于 nMCP 的光中子成像方法

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利用电子加速器光中子源来开展融合中子与 X 射线的双模成像已被证明是一种可行的方法。在已有的技术方案中，我们采用基于“nMCP+ 闪烁屏 +CMOS”的方案来测量中子图像，成功获得了中子/光子融合图像并实现了双模物质识别，但同时也注意到了该探测方案所遇到的两个技术困难：（1）X 射线脉冲对中子探测的干扰和（2）探测器级联过程导致的统计性恶化。为此，研究了基于 event-count 模式的 nMCP 探测器来开展光中子成像的问题，通过设置优化的实验条件，在强 X 射线干扰场下，得到了信本比较高的中子图像，可在相对更短的时间内获得更好的图像质量，为基于 event-count 模式 nMCP 探测器的双模成像方法奠定了基础。本报告将对光中子成像的技术原理和 nMCP 探测器的成像方法开展介绍。

Summary:

Parallel Session IX (1)：TeV and BSM Physics / 344

Explaining The New CDF II W-Boson Mass Data In The Georgi-Machacek Extension Models

作者： Xiaokang Du[1]

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Georgi-Machacek model can hardly account for the new CDF II data on W-boson mass in its original form. As anticipated, unless additional tree level $SU(2)_c$ custodial symmetry breaking effects are non-negligible, the new physics contributions to Δm_W is always very small. Our numerical results show that ordinary GM model can contribute to Δm_W a maximal amount 0.0012 GeV, which can not explain the new CDF II data on W boson mass. We propose to introduce small misalignment among the triplet VEVs to increase Δm_W, which can reach 0.06 GeV for $v_\xi - v_\chi \sim 6$ GeV, marginally explain the new data in 2σ range. We also propose to extend the GM model with low scale RH neutrino sector, which can adopt the leptogenesis mechanism and act as a large $SU(2)_c$ breaking source because of its correlation with h_{ij}. With low scale RH neutrino mass scale of order $10^2 \sim 10^4$ TeV, the new physics contributions to Δm_W can reach 0.03 GeV. Combining both small $SU(2)_c$ breaking effects, the small misalignment among the triplet VEVs and large h_{ij} couplings, the 1σ range of CDF II data on W boson mass can be obtained even for small splitting among the triplet VEVs with $v_\xi - v_\chi \approx 1$ GeV.

Parallel Session VIII (3)：Heavy Ion Physics / 345

Physics at Electron Ion Colliders

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Electron Ion Colliders are proposed in both US and China. In this talk, I will discuss the main physics programs in these facilities.

Parallel Session IX (5)：Particle Detector Technology / 347

Introduction of DAQ System’s Firmware of Giant Radio Array for Neutrino Detection

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Giant Radio Array for Neutrino Detection (GRAND) is a high-energy neutrino and cosmic ray telescope under construction, it detects particles by radio emissions of extensive air shower. A single site of the array includes one central station and many detection units, the firmware running on

the Data Acquisition (DAQ) board of detection units performs baseline correction, filtering and triggering on the ADC sampling data, and communicates wirelessly with the central station to obtain instructions and transmit timestamps or science data. We are updating the firmware design based on the previous work.

Parallel Session VI (5)：Particle Detector Technology / 348

LHAASO 数据获取系统

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高海拔宇宙线观测站（LHAASO）是以宇宙线观测研究为核心的重大科技基础设施，包括三个（KM2A、WCDA、WFCTA）阵列实验，探测单元和电子学系统分布在 1.36 平方公里的实验场地上。LHAASO 采用前端数字化、无全局硬件触发的电子学方案，利用 White Rabbit(WR) 技术实现前端电子学时钟同步。数据获取系统包括在线计算集群、读出网络构成的硬件平台和数据获取软件，基于 WR 和商用交换机构成的以太网实现前端电子学与数据获取软件的通信。整套数据获取软件（EDAQ）基于 C++/python 语言自主研发，包括在线服务、数据流软件和运行控制软件三部分。在线服务提供数据流进程管理、信息共享、控制指令收发等接口。数据流软件设计并实现了读出、时间片数据组装、软件触发和存储的流处理模型，所有数据流模块均可在计算集群中运行多个副本，并行处理输入数据，在数据流管理软件协调下实现负载平衡。为满足实验无人值守运行需求，读出模块自动侦测并屏蔽异常的读出电子学单元；运行控制软件实时检查数据流软件和计算节点的运行状态，检测到异常时，自动修改运行配置并重启数据流软件，实现故障自动恢复。

LHAASO 实验采用边建设边运行模式，2019 年初 KM2A 四分之一阵列开始正式物理运行。在保证实验运行和数据质量的要求下，数据获取系统完成中、后期硬件平台建设和软件迭代工作，并于 2021 年 6 月完成全部建设任务。2021 年 8 月，数据获取系统通过性能工艺测试，达到 4.6GB/s 读出和在线处理能力。

Summary:

1. 自主研发 EDAQ 软件，面向标记全局时间戳的电子学数据实现高性能数据获取与软件触发；
2. 实现常见故障自动侦测与恢复，满足 LHAASO 实验无人值守运行需求；
3. LHAASO 数据获取系统已完成建设任务并稳定运行 1 年。

Parallel Session II (5)：Particle Detector Technology / 349

JadePix-3 Monolithic Pixel Sensor Telescope: The DAQ system Developments and Recent Measurement

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JadePix-3 是一款基于 TowerJazz CIS 180nm 工艺设计的全功能大尺寸的探测器芯片。环形正负电子对撞机 (CEPC) 对顶点探测器性能有极高的技术要求，JadePix-3 着重对空间分辨率、功耗等对 CEPC 顶点探测器性能有重要影响的参数展开研究。束流望远镜是对探测器的探测效率、位置分辨率等参数测试和刻度的重要测试工具，对高性能探测器研发具有重要意义，同时它也是一个高精度粒子径迹探测系统。粒子物理实验不断增加的规模和复杂度对探测器精度要求越来越高，目前国内外束流望远镜系统已无法满足日益增长的性能需求。

JadePix-3 的功耗和位置分辨率等指标都达到领域内领先水平。本报告将介绍基于 JadePix-3 设计的束流望远镜系统。不同于单个芯片读出测试，束流望远镜的数据获取系统 (DAQ)、触发系统 (Trigger)、数据在线/离线分析/径迹重建、实时监控 (Online-Monitor) 等功能的实现都有较大挑战。报告将对相关内容进行介绍，同时展示 JadePix-3 束流望远镜基于宇宙线和放射源等性能测试结果。

Parallel Session I (3)：Heavy Ion Physics / 350

Higher twist transverse momentum dependent parton distribution functions in the MIT bag model

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We study the transverse-momentum-dependent parton distribution functions (TMDs) up to twist-4 in the MIT bag model. Besides the TMDs defined from the quark-quark correlator, we have also calculated those defined via quark-j-gluon-quark correlators and four-quark correlators for the first time. All the T-even and T-odd TMDs are computed to the α_s^1 level. Furthermore, we quantitatively evaluate the azimuthal asymmetries in SIDIS resulted from those TMDs. The numerical results show that twist-4 contributions can provide 20 percent corrections to the leading twist correction for the $\langle \sin(\phi - \phi_S) \rangle_{UT}$ and $\langle \cos(\phi - \phi_S) \rangle_{LT}$ asymmetries and the twist-3 effects varies between a few percent and 20 percent at low-Q^2.

Parallel Session X(1)：TeV and BSM Physics / 351

Searching for fractionally charged particles in space with DAMPE

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The existence of fractionally charged particles (FCP) in present is some extensions to the Standard Model of particle physics, and their detection would be a significant breakthrough. Most of the previous cosmic-rays (CRs) studies are mainly focused on the secondary CRs from the extensive air shower, but there is rarely on-orbit study to search FCP from primary CRs. The DArk Matter Particle Explorer (DAMPE) was launched into space on the 17th December 2015, and it has been working well

in space for more than five years with the purpose of measuring CRs and gamma-rays and as today a large amount of scientific data has been acquired. In this work the five years ' on-orbit data of DAMPE have been analyzed for the search of 2/3 fractionally charged particle (FCP). The FCP is assumed to have high penetration capability, and therefore in the selections the particle is required to penetrate the entire detector from top to bottom. Two sub-detectors, the Plastic Scintillator Detector (PSD) and the Silicon Tungsten tracKer (STK), are used for charge discrimination. The Geant4 simulations toolkit is used to investigate the signal region and selection efficiency of 2/3 FCP in the detector. No FCP signal is found with DAMPE. The results and detailed selection methods and progress of DAMPE will be presented and discussed.

Parallel Session X(1)：TeV and BSM Physics / 353

Mass dimension one fermions: Recent progress

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Mass dimension one fermions are a new class of spin-half particles that are physically distinct from the Dirac fermions. They satisfy the Klein-Gordon but not the Dirac equation. They have mass dimension one instead of three-half thus endowing them with a renormalizable quartic self-interaction. Here, we report the recent progress of the theory as elucidated in **Phys.Rept. 967 (2022) 1-43**. We focus on the kinematics of the fermions, present the new S-matrix formalism and the generalised unitarity relation.

Parallel Session IX (5)：Particle Detector Technology / 358

面向大科学装置的高性能数据流处理框架 DSNI

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通过研究谱仪类大科学装置，如同步辐射光源和散裂中子谱仪的运作和数据流特征，对状态监测和数据处理业务进行抽象建模和流式适配。突破传统的基于文件方式的数据传输和分析瓶颈，以高性能分布式数据传输平台和自研分析平台承载各类中子谱仪数据流，聚合不同来源的测量数据和其他实验参量，为谱仪实验提供基于数据驱动的高性能准实时数据流处理平台。最终实现信息域深度挖掘、智能化运维管理和准实时性的数据分析，帮助谱仪从各种多模态实验方法中准确鉴别和定位测量信号量，为新兴的大数据实验方法提供基本支撑。

Summary:

作为研究物质微观结构和动力学性质的基础工具，脉冲中子源和同步辐射光源等谱仪类大科学装置在基础研究和材料分析等科学领域发挥着极为重要的作用，是相关新技术产业的强大支撑。近年来随着谱仪类大型科学装置的升级，不但其数据流的规模和复杂程度在膨胀，各种新型多模态实验也需要从越来越复杂的测量数据中精确鉴别和定位有效的测量信号。在多模态测量中，各种实验状态的实时监控和大规模数据的准实时同步聚合与分析反馈是其重要的逻辑内容，需要有一个通用性好运行效率高，且支持大数据聚合发掘的高性能数据流处理平台来承载各种数据处理业务。DSNI 数据处理框架针对谱仪类大型科学装置的数据流特征，从底层硬件规范到上层应用的各个环节对数据流抽象模型进行适配和规范设计，创建通用化数据传输和处理框架，实现不同数据源的同步标记和聚合处理，并划分不同用户区域进行专项优化。同时通过结合实验控制系统，为数据处理各环节建立通讯接口，从而实现实验方法的信息反馈。框架整体提供了对多模态实验大规模数据进行深度发掘的支持能力，是新一代谱仪提升运行性能，应用新型多模态实验方法的基础支撑。

Parallel Session VI (5)：Particle Detector Technology / 359

中国散裂中子源中子探测器读出电子学研制进展报告

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散裂中子源由于其提供的中子束脉冲时间结构好，强度高，能谱宽，成为中子散射研究和应用的先进工具。中国散裂中子源是我国第一台散裂中子源，填补了我国在此类大科学装置领域的空白。中国散裂中子源共设计预留了 20 条中子通道，可建设 20 台左右的中子谱仪，一期工程已建成并对用户开放 3 台，现正与粤港澳大湾区的高校、研究机构积极开展合作，共同建设 8 台合作谱仪。中子谱仪探测器读出电子学是中子谱仪的重要组成部分，用于对中子探测器产生的信号进行放大、成形后进行时间、位置和能量等测量，并将这些测量得到的数据送往后端数据获取系统进行相应的中子击中位置和飞行时间信息重建。

中国散裂中子源的中子谱仪探测器主要采用了基于位置灵敏 3He 管探测器的大面积 3He 管阵列中子探测器和基于闪烁体探测器 + 波移光纤 +SiPM 的大面积闪烁体中子探测器两种方案，而相应的读出电子学也是针对两种探测器的要求与特征进行了研制与工程化实施。针对 3He 管阵列中子探测器，读出电子学采用电荷灵敏前放对 3He 管两端进行电荷积分以及成形，通过高速 ADC 对成形后的信号进行数字化并进行数字寻峰并使用电荷分配法获取中子击中 3He 管的具体位置。针对需要将探测器以及电子学放置于真空中这一特殊要求，中国散裂中子源探测器电子学团队正在积极从低功耗自研前放 ASIC 以及低功耗数字化电子学两方面着手开展相关研究。针对闪烁体型中子探测器，由于其通道数多，通过使用高集成度多通道自研前端 ASIC 芯片对 SIPM 输出的信号进行放大与甄别，输出的甄别信号被高速 FPGA 接收进行计数。飞行时间测量则通过测量全局打靶 T0 信号和中子信号过阈时间之间的时间差实现，通过飞行时间可以获取击中中子的能量信息。

Summary:

中国散裂中子源的探测器与电子学团队完成了一期工程及合作谱仪中的 6 台中子谱仪读出电子学的研制和工程化实施，现正在承担 5 台中子谱仪探测器读出电子学的建设工作。目前针对 3He 管类探测器，读出电子学系统已经能实现 7.5 毫米（针对 1 米标准 3He 管）的位置分辨能力，与国际先进水平相当。并且在真空中直接工作的读出电子学方向研制成功了多款前放 ASIC 芯片，并在低功耗数字化电子学部分取得了重要进展。针对闪烁体类型中子探测器，已经研制成功一款多通道前放 ASIC 芯片与成熟的全链路读出电子学方案，有能力对万通道量级的闪烁体探测器进行读出，并达到中子谱仪对计数率和时间测量精度等其它性能参数的要求。

Parallel Session II (3)：Heavy Ion Physics / 360

集体流测量新进展——从小系统到大系统

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中高能重离子碰撞中，集体流是研究夸克胶子等离子体的重要探针。本报告将着重介绍近期小系统及大系统中集体流测量结果。

Parallel Session III (2)：Hadron and Flavor Physics / 361

Explaining the b->s l l anomalies in Z' scenarios with top-FC/FCNC couplings and its implications for the W-boson mass shift

作者： 东洋王 [1]; 亚东杨 [2]; 兴博袁 [2]; 新强李 [3]; 泽俊谢 [3]; 萌沈 [3]

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在文章 arXiv:2112.14215（李新强，沈萌，王东洋，杨亚东，袁兴博）和 arXiv:2205.02205（李新强，谢泽俊，杨亚东，袁兴博）中，我们分别研究了用具有顶夸克味改变和味守恒中性流的Z'模型来解释$b \to s\ell^+\ell^-$反常。在后一工作中，我们还考虑了额外解释最近 CDF 观测到的 W 玻色子质量的可能性。

Summary:

Parallel Session IX (5)：Particle Detector Technology / 362

基于 3He 管中子位置灵敏探测器的真空下低功耗读出电子学设计

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中国散裂中子源（CSNS）规划的大部分中子谱仪都是基于 3He 管位置灵敏探测器。为了减少空气对中子散射实验的影响，探测器需要放置在真空腔中，同时为了减少穿越真空腔的电缆数量以及提高电信号的信噪比，电子学读出系统也需要紧靠探测器放置于真空腔中。由于 3He 管探测器的命中位置是通过电荷分配法计算得到的，准确的脉冲峰值获取需要 ADC 工作在高速采集状态下，目前基于这种方法的读出电子学系统功耗都较高，不适合应用在没有空气对流，电子学散热困难的真空中。因此, 为实现电子学在高速高精度采样的同时还能以极低功耗运行的目标，我们从以下几个方面进行了研究：(1) 用低功耗 ASIC 芯片代替分立器件模拟前端电路；(2) 使用先进低功耗 ADC 芯片和 FPGA；(3) 通过时钟门控系统以降低数字动态功耗；(4) 采用高效散热介质，有效地将热量传导至 3He 管探测器的金属机械结构。基于上述

部分方法开发了第一代原型机，测试功耗为 4.4W。而目前基于上述所有方法的 8 管探测器模块读数电子学原型已经开发完成，正在进行测试，最新一代电子学的整体功耗预计在 3W 左右，满足真空下应用的目标。

Parallel Session IX (5)：Particle Detector Technology / 363

CEPC MOST2 vertex detector module assembly with Gantry system

作者： 鑫辉黄 [1]

[1] 中科院高能所

Content: We will develope the assembly procedure steps including required tooling in CEPC MOST2 vertex detector module assembly. We are developing an automatic method to glue the sensor onto the flexible PCB cable with a precision of tens of micrometers. Our main goal is to develope module assembly with an automatic robot. Now we have designed some of the tooling and performed simple gluing test.

Parallel Session III (2)：Hadron and Flavor Physics / 364

Deciphering the long-distance penguin contribution to B → γγ decays

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We compute for the first time the long-distance penguin contribution to the double radiative B-meson decays
due to the purely hadronic operators acting with the electromagnetic current in the background soft-gluon field
from first field-theoretical principles by introducing a novel subleading B-meson distribution amplitude.
The numerically dominant penguin amplitude arises from the soft-gluon radiation off the light up-quark loop rather than the counterpart charm-loop effect on account of the peculiar analytical behaviour of the short-distance hard-collinear function. Importantly the long-distance up-quark penguin contribution brings about the substantial cancellation of the known factorizable power correction possessing the same multiplication CKM parameters, thus enabling $B_{d,\,s} \to \gamma\gamma$ to become new benchmark probes of physics beyond the Standard Model.

Parallel Session VIII (1)：TeV and BSM Physics / 365

Using machine learning methods to study aQGCs and nTGCs

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合作者： Tong Li [2]; Yu-Chen Guo [3]; 崇兴岳 [4]

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Machine learning has been developing rapidly in recent years, and it has become an important topic to leverage the power of machine learning in the phenomenological study of new physics beyond the Standard Model. We will present our recent works on the use of machine learning algorithms in the investigation of aQGCs and nTGCs.

Parallel Session II (2)：Hadron and Flavor Physics / 366

Double-charm tetraquark under the complex scaling method

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We investigate the T_{cc}^+ as a DD^* molecule with $J^P = 1^+$ in the framework of the one-boson-exchange potential model. The isospin breaking effect and $S - D$ wave coupling are taken into account carefully. We adopt the complex scaling method to study the DD^* system and obtain a quasibound state corresponding to the T_{cc}^+.

Summary: The binding energy of DD^* system relative to the D^0D^{*+} and width are -354 keV and 61 keV respectively. The isospin breaking effect is found to be enormous, and the $S-$wave D^0D^{*+} and D^+D^{*0} components give dominant contributions with the probabilities of 72.1% and 27.1% respectively. In addition, we do not find any resonances in the $\bar{D}D^*$ system. As a by-product, we study the $X(3872)$ as a $(D\bar{D}^* - D^*\bar{D})/\sqrt{2}$ molecule with $J^{PC} = 1^{++}$. We also find a quasibound state corresponding to the $X(3872)$. Its binding energy relative to the $D^0\bar{D}^{*0}$ threshold and width are -111 keV and 26 keV respectively. The $S-$wave $(D^0\bar{D}^{*0} - D^{*0}\bar{D}^0)/\sqrt{2}$ component dominates this state with the probability of 92.7%.

Summary:

Plenary SessionI / 367

辽宁师范大学校长苑晓杰教授致辞

368

辽宁师范大学高能物理理论与实验研究中心揭牌仪式

Plenary SessionI / 369

高能物理分会工作报告

作者： Yifang Wang[1]

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Plenary SessionI / 370

高能物理现状与展望——Snowmass 研究总结

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Summary:

Plenary Session II / 371

LHAASO 研究进展报告

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Plenary Session II / 372

TeV 物理实验进展综述

相应作者： qliphy0@pku.edu.cn

Plenary Session II / 373

微扰 QCD 和精确计算研究进展

相应作者： zhuhx@zju.edu.cn

Plenary Session III / 374

振幅计算和有效场论研究进展

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Plenary Session III / 375

格点 QCD 研究进展

相应作者： hengtong.ding@mail.ccnu.edu.cn

Plenary Session III / 376

高能重离子碰撞物理综述

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Plenary Session IV / 377

加速器最新原理和技术研究进展

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Summary:

Plenary Session IV / 378

强子物理理论研究进展

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Plenary Session IV / 379

强子物理实验研究进展

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Plenary Session V / 380

未来对撞机研究进展（包括 CEPC 和 STCF）

相应作者： li.gang@mail.ihep.ac.cn

Plenary Session V / 381

暗物质理论综述

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Plenary Session V / 382

暗物质测量

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Plenary Session VI / 383

中微子理论进展

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Plenary Session VI / 384

中微子实验研究进展

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Plenary Session VI / 385

高能物理发展战略规划进展

Parallel Session III (6)：晨光杯评选 / 386

Explaining the Many Threshold Structures in the Heavy-Quark Hadron Spectrum

Parallel Session III (6)：晨光杯评选 / 387

Lattice QCD calculation of the two-photon exchange contribution to the muonic-hydrogen Lamb shift

Parallel Session III (6)：晨光杯评选 / 388

Next-to-Next-to-Leading-Order QCD Prediction for the Photon-Pion Form Factor

Parallel Session III (6)：晨光杯评选 / 389

Measurement of the Absolute Branching Fraction of Ds +⟶ τ+ ντ via τ+ ⟶ e+ νeντ

Parallel Session III (6)：晨光杯评选 / 390

Model-Independent Determination of the Spin of the Ω− and Its Polarization Alignment in ψ(3686) ⟶ Ω−Ω¯ +

Parallel Session III (6)：晨光杯评选 / 391

Measurement of the Cross Section for e+ e− ⟶ Hadrons at Energies from 2.2324 to 3.6710 GeV

Parallel Session IV (6)：晨光杯评选 / 392

Phase transition dynamics and gravitational wave spectra of strong first-order phase transition in supercooled universe

Parallel Session IV (6)：晨光杯评选 / 393

Observation of a Near-Threshold Structure in the K+ Recoil-Mass Spectra in e+ e− ⟶ K + (Ds− D*0 + Ds*−D0)

Parallel Session IV (6)：晨光杯评选 / 394

R&D of ultra-fast 8 * 8 anodes MCP-PMT

Parallel Session IV (6)：晨光杯评选 / 395

通过多玻色子过程检验标准模型及探索超出标准模型的新物理

Parallel Session IV (6)：晨光杯评选 / 396

D 士 D*∓ Hadronic Atom as a Key to Revealing the x（3872）Mystery

397

中国散裂中子源探测器研制进展

相应作者： sunzj@ihep.ac.cn

板：360 / **399**

Talk 1

400

Talk 2

401

Talk 3

Parallel Session III (1)：TeV and BSM Physics / 402

格点规范场论模拟早期宇宙一阶相变

作者：立功边 [1]

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格点模拟为计算早期宇宙对称性破缺过程及其可能产生的随机引力波功率谱提供了可能，这为引力波探测实验提供了重要的随机引力波源，引力波探测实验可以和对撞机实验互补的来区分早期宇宙对称性破缺的模式及其背后的新物理。我将在此报告中和大家分享我们利用格点规范场论模拟早期宇宙对称性破缺过程所取得的一些进展，包括：强一阶电弱相变和宇宙弦形成等的研究。

403

Study of charmed baryons at Belle

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404

Time-dependent Dalitz Analysis package DAFNE and Dalitz plot analysis of D0 -> K- pi+ eta at Belle

相应作者： wenbiao@ustc.edu.cn

Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 405

Probing QCD critical point and induced gravitational wave by black hole physics

相应作者： hesong@jlu.edu.cn

Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 406

Primordial Black Hole Dark Matter in an era of Gravitational Wave Cosmology

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Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 407

Pulsar Timing Residuals induced by Wideband Ultralight Dark Matter

Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 408

Domain walls from spontaneous breaking of discrete symmetries

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Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 409

Gravitational waves from phase transitions: recent progress on the bubble expansion

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Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 410

Anisotropy of phase transition gravitational wave and its implication for primordial seeds of the Universe

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Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 411

ADM formulation and Hamiltonian analysis of $f(Q)$ gravity

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Parallel Session V (4)：Neutrino, Astroparticle Physics and Cosmology / 412

Static and spherically symmetric solutions in $f(Q)$ gravity

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Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 413

Minimal typeII seesaw leptogenesis

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Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 414

Theoretical predictions for far-forward tau neutrinos at the Large Hadron Collider

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Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 415

Origin of Neutrino Masses on the Convex Cone of Positivity Bounds

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Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 416

Non-unitary Leptonic Flavor Mixing and CP Violation in Neutrino-antineutrino Oscillations

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Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 417

Accidental symmetries in the scalar potential of the Standard Model extended with two Higgs triplets

Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 418

Soft Scattering Evaporation of Dark Matter Subhalos by Inner Galactic Gases

Parallel Session VI (4)：Neutrino, Astroparticle Physics and Cosmology / 419

Neutron star limits on neutron-mirror-neutron oscillation

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Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 420

LHAASO-KM2A status

作者： Cong Li[1]

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Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 421

LHAASO-WCDA data analysis and sky survey of VHE gamma ray sources

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Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 422

A real-time monitor for TeV Blazar with LHAASO-WCDA

Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 423

Measuring VHE diffuse gamma-ray emission from Galactic Plane with LHAASO-WCDA

Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 424

PeV 宇宙射线大尺度各向异性测量

Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 425

Horizontal air showers and electron neutrino search with LHAASO-KM2A

426

AMS 高能宇宙线电子流强的最新结果

Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 427

AMS 低能正电子时变流强测量

428

AMS 实验初级宇宙线的最新结果

Parallel Session VIII (2)：Hadron and Flavor Physics / 430

The Time-dependent Dalitz Analysis package DAFNE and Dalitz plot analysis of D0 -> K- pi+ eta at Belle

作者： Wenbiao Yan[1]

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含时达利兹分析方法是研究 D0-D0bar 混合和 CP 破坏的重要研究手段。考虑 Belle II 计划

采集的 50 ab-1 数据的 D0/D0bar 样本大小，目前没有发表的模型依赖的含时达利兹程序包，我们

需要提高模型依赖的含时达利兹分析速度。根据 Hydra 分析框架，我们研发 C++ 的含时达利兹分析

程序包 DAFNE。根据 Belle 的 953fb-1 数据，采用达利兹分析方法研究 D0->K- pi+ eta，通过

K pi/eta 不变质量谱研究 K* 激发态。

Parallel Session VI (2)：Hadron and Flavor Physics / 431

Pion and Kaon Distribtuion Amplitudes from Lattice QCD

作者： 俊华 [1]

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Pion and Kaon Distribtuion Amplitudes from Lattice QCD

Parallel Session I (2)：Hadron and Flavor Physics / 432

Double J/psi at ATLAS

作者： Yue Xu[1]

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Double J/psi at ATLAS

Parallel Session I (2)：Hadron and Flavor Physics / 433

Double J/psi at CMS

作者： 震胡 N[one]

相应作者： zhenhu@tsinghua.edu.cn

Double J/psi at CMS

Parallel Session V (2)：Hadron and Flavor Physics / 434

Study of charmed baryons at Belle

作者： Yubo Li[1]

[1] 复旦大学

相应作者： liyb@ihep.ac.cn

Precision charmed hadron spectroscopy helps in understanding how the matter is made around us. The large data sample accumulated by the Belle experiment at the KEKB asymmetric-energy e+e− collider provides us a unique opportunity to perform these studies. We report recent results on charmed baryon spectroscopy from Belle, which include measured branching fraction of (newly discovered) decays of Lambda_c, Xi_c and Omega_c, the evidence of Lambda_c(2910), and the CPV studies in charmed baryon sector, etc.

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 435

Status, performance and recent results of PandaX

相应作者： wangqiuhong@fudan.edu.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 436

使用 PandaX-4T 探测器精确测量 Xe-136 双贝塔衰变半衰期

相应作者： silin123@sjtu.edu.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 437

Latest Results From Daya Bay

相应作者： chenzhiyuan@ihep.ac.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 438

JUNO Neutrino Mass Ordering Sensitivity

相应作者： zhangjinnan@ihep.ac.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 439

Precision Measurement of Neutrino Oscillation Parameters in JUNO

相应作者： caocy@ihep.ac.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 440

Simulation Study of Searching for Proton Decay in JUNO

相应作者： guoyuhang@stu.xjtu.edu.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 441

Prospects for Detecting the Diffuse Supernova Neutrino Background in JUNO

相应作者： chengjie@ncepu.edu.cn

Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 442

Reactor Neutrino Flux and Spectrum Evolution At Daya Bay

相应作者： 185154014@qq.com

443

Solar neutrino physics with JUNO

相应作者： luhq@ihep.ac.cn

Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 444

利用 PandaX-4T 实验寻找太阳 pp 中微子

相应作者： luxy_eagle@mail.sdu.edu.cn

Parallel Session VIII (4)：Neutrino, Astroparticle Physics and Cosmology / 445

Searches of low mass dark matter at PandaX-II and PandaX-4T experiments

相应作者： wumm9@mail2.sysu.edu.cn

Parallel Session VIII (4)：Neutrino, Astroparticle Physics and Cosmology / 446

Study of accidental coincidence background in PandaX-II and PandaX-4T

相应作者： abdusalam@sjtu.edu.cn

Parallel Session VIII (4)：Neutrino, Astroparticle Physics and Cosmology / 447

XENONnT 实验进展

相应作者： lkx21@mails.tsinghua.edu.cn

Parallel Session VIII (4)：Neutrino, Astroparticle Physics and Cosmology / 448

XENONnT 实验中的偶然符合本底

相应作者： xudachengthu@hotmail.com

Parallel Session VIII (4)：Neutrino, Astroparticle Physics and Cosmology / 449

磁单极子

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 450

Search for Solar ^8B Neutrino in the PandaX-4T Experiment using Neutrino-Nucleus Coherent Scattering

相应作者： wenboma@sjtu.edu.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 451

Searching for absorption signal of fermionic dark matter in PandaX-4T experiment

相应作者： taoyi92@sjtu.edu.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 452

Search for the Cosmic Ray Boosted Sub-GeV Dark Matter at the PandaX-II Experiment

相应作者： hongloumeng@sjtu.edu.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 453

Dark Matter Search in the CMB

相应作者： gaoyu@ihep.ac.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 454

Data Processing in the MeV Energy Range in PandaX-4T

相应作者： lingyinluo@pku.edu.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 455

江门中微子实验能量分辨率研究进展

相应作者： wangyaoguang@ihep.ac.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 456

江门中微子实验刻度系统研制进展

相应作者： huijiaqi@sjtu.edu.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 457

Multi Calorimetry in Liquid Scintillator Neutrino Detector

相应作者： hany88@mail.sysu.edu.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 458

Vertex and Energy Reconstruction in JUNO

相应作者： huanggh@ihep.ac.cn

Parallel Session IX (4)：Neutrino, Astroparticle Physics and Cosmology / 459

Design optimization of performance for JUNO-TAO plastic scintillator with wavelength shifter fiber

相应作者： luog7@mail2.sysu.edu.cn

460

Study on pulse shape discrimination power of plastic scintillators

相应作者： lupzh@mail2.sysu.edu.cn

Parallel Session I (4)：Neutrino, Astroparticle Physics and Cosmology / 461

AMS 高能宇宙线正电子流强的最新结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 462

AMS 高能宇宙线电子流强的最新结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 463

AMS 反质子能谱最新结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 464

AMS 反质子时变流强测量

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 465

AMS 宇宙线电子与质子时变流强的测量结果与物理解释

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 466

AMS 实验初级宇宙线的最新结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 467

AMS 实验次级宇宙线的最新结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 468

AMS 关于第三类宇宙线的实验结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 469

AMS 原子核同位素测量的最新结果

Parallel Session II (4)：Neutrino, Astroparticle Physics and Cosmology / 470

AMS 实验伽马射线顶点重建算法与伽马射线极化研究

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 471

Orbit performance and latest result of the DArk Matter Particle Explorer

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 472

HERD 科学研究介绍

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 473

大型超高能伽马源立体跟踪观测设备（LACT）计划介绍

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 474

Cosmic rays propagation with slow disk

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 475

Fast Termination Shock Acceleration on Solar Flare Jet

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 476

A study of Force-field Approach from the time-dependent spectrum of AMS02 and PAMELA.

477

新一代高能量粒子对撞机超导磁体技术研究进展

相应作者： xuqj@ihep.ac.cn

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 478

南海中微子望远镜 – 海铃计划

作者： Donglian Xu[1]

[1] *Shanghai Jiao Tong University*

相应作者： donglianxu@sjtu.edu.cn

Parallel Session III (4)：Neutrino, Astroparticle Physics and Cosmology / 479

超大规模中微子望远镜的模拟进展

作者： 王子珂 None

相应作者： wangzike@ihep.ac.cn

Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 480

JUNO-TAO Status and Prospect

作者： 李茹慧 None

相应作者： lirh@ihep.ac.cn

Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 481

Observation of the high-energy reactor neutrinos

作者： 赵润泽 None

相应作者： zhaorz@ihep.ac.cn

Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 482

利用液氙探测器测量反应堆中微子的相干弹性散射

作者： Xiang Xiao[1]

[1] *Sun Yat-Sen University*

相应作者： xiaox93@mail.sysu.edu.cn

Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 483

Coherent elastic neutrino-nucleus scattering and quenching factor

作者： Jiajun Liao[1]

[1] *Sun Yat-Sen University*

相应作者： liaojiajun@mail.sysu.edu.cn

Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 484

Lastest nH oscillation results from Daya Bay

作者： Jinjing Li[1]

[1] *Tsinghua University*

相应作者： lijj16@mails.tsinghua.edu.cn

485

用于 CEPC 内层顶点探测器的高计数率 CMOS 像素探测器芯片研制

486

ATLAS 硅微条探测器读出芯片的单粒子效应研究

487

Design of the Readout Electronics for the TRIDENT Pathfinder Experiment

488

CEE 径迹探测器前端读出电子学研究进展

489

高精度时间测量电子学技术研究进展

490

中国散裂中子源中子探测器读出电子学研制进展报告

491

基于 100G 以太网和 GPU 的 4G 采样率实时信号处理系统

492

LHAASO 数据获取系统

493

为宇宙线 muon 成像设计的基于 HTM 方法的无触发电子学

494

BEPCII 本底研究实验

495

CEPC 同步辐射研究进展

496

面向同步辐射光源图像的智能无损压缩方法

497

基于神经网络的高时间分辨 ECAL 读出电子学研究

498

面向高能物理数据处理的可计算存储系统设计与实现

499

大型中微子射电探测望远镜 GRAND-原型阶段数据获取系统设计

500

BEPCII 本底研究实验

Parallel Session III (3): Heavy Ion Physics / 501

Does quark-gluon plasma feature an extended hydrodynamic regime?

相应作者： phyyin@gmail.com

Parallel Session IV (3)：Heavy Ion Physics / 502

高温高密 QCD 物质中守恒荷涨落性质的研究

相应作者： glma@fudan.edu.cn

Parallel Session V (3)：Heavy Ion Physics / 503

Finite size and interface effects on the QCD phase trasition

相应作者： yxliu@pku.edu.cn

Parallel Session IX (3)：Heavy Ion Physics / 504

Spin polarization induced by magnetic field and rotation

相应作者： huangm@mail.ihep.ac.cn

Parallel Session IX (3)：Heavy Ion Physics / 505

Time evolution of global polarization within an improved microscopic approach

作者： 晓雯李 [1]

[1] *SDU*

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Parallel Session IV (4)：Neutrino, Astroparticle Physics and Cosmology / 506

Sterile neutrino studies using Daya Bay, MINOS, and Bugey-3 data

作者： shiqi zhang[1]

[1] *Sun Yat-Sen University*

相应作者： zhangshq33@mail2.sysu.edu.cn

Parallel Session IX (5)：Particle Detector Technology / 507

Spacer configuration optimization for RPCs based on COMSOL Multiphysics simulation

作者： Lining Mao[1]

[1] *Shanghai Jiao Tong University*

相应作者： mln517@sjtu.edu.cn

The uniformity of the gas flow in the chamber and the deformation of the electrode plates are critical to the performance of RPC (Resistance Plate Chamber). In this talk, a new design of RPC with "shifted" spacer configuration and less spacer number is come up. The different behaviors of the gas flow field, electrode's deformation and electric field between RPCs with new spacer configuration and classical aligned configuration are studied through COMSOL Multiphysics which is a simulation platform based on finite element method. And the performance of the prototypes based on these two design have been tested.

Parallel Session I (2)：Hadron and Flavor Physics / 508

(Semi-)leptonic D decays at BESIII

Parallel Session I (1)：TeV and BSM Physics / 509

A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery

相应作者： lugc@ihep.ac.cn

Parallel Session I (1)：TeV and BSM Physics / 510

Combined measurement of Higgs properties

作者： Jin Wang[1]

[1] *IHEP*

相应作者： wangjin3@ihep.ac.cn

Summary:

Parallel Session I (1)：TeV and BSM Physics / 511

Resummation of large logarithms in cross sections at subleading power

相应作者： j.wang@sdu.edu.cn

Parallel Session I (1)：TeV and BSM Physics / 512

H→γγ fiducial and differential cross-section in diphoton channel with full Run2 dataset at ATLAS

相应作者： fabiolucioalves@gmail.com

Parallel Session I (1)：TeV and BSM Physics / 513

Recent Higgs measurements in diboson channels at the ATLAS detector

作者： Dongshuo Du[1]

[1] *USTC*

Summary:

Parallel Session I (1)：TeV and BSM Physics / 514

Higgs properties measurements in ZZ and diphoton channels: cross sections, mass at CMS

相应作者： taojq@mail.ihep.ac.cn

Parallel Session I (1)：TeV and BSM Physics / 515

Measurement of the Higgs boson width in ZZ final states at CMS

Parallel Session II (1)：TeV and BSM Physics / 516

Search for a new gauge boson Z' in 4μ events with the ATLAS experiment

Parallel Session II (1)：TeV and BSM Physics / 517

Search for scalar leptoquarks in the bττ final state in pp collisions at √s=13 TeV with the ATLAS detector

Parallel Session II (1)：TeV and BSM Physics / 518

Is FCNC current hiding out with Higgs?

相应作者： xiamm18@mails.tsinghua.edu.cn

Parallel Session II (1)：TeV and BSM Physics / 519

Search for resonances decaying to three W bosons in proton-proton collisions at sqrt(s)=13TeV at CMS

相应作者： xudong.lyu@cern.ch

Summary:

Parallel Session III (1)：TeV and BSM Physics / 520

Search for the direct production of charginos and neutralinos in final states with tau leptons in 13 TeV pp collisions with the ATLAS detector

作者： UNKNOWN 蔡雨辰 None

相应作者： caiyc@ihep.ac.cn

Summary:

Parallel Session III (1)：TeV and BSM Physics / 521

CP violation in ttH and tH in multilepton channels (includes combination) at CMS

Parallel Session III (1)：TeV and BSM Physics / 522

Measurement of top-Yukawa CP and Higgs EFT in ZZ and tautau final states at CMS

作者： 悦凯宋 [1]

[1] *zju*

相应作者： songyk@zju.edu.cn

Summary:

Parallel Session III (1)：TeV and BSM Physics / 523

Study of the CP property of the Higgs to vector-boson coupling in the VBF H → γγ channel with the ATLAS detector

相应作者： boliu@cern.ch

Parallel Session III (1)：TeV and BSM Physics / 524

从在壳振幅到高维算符——构建有效场论中任意维数的算符基

Parallel Session IV (1)：TeV and BSM Physics / 525

Search for Higgs boson decay to a charm quark-antiquark pair in proton-proton collisions at sqrt(s) = 13 TeV at CMS

相应作者： licongqiao@pku.edu.cn

Parallel Session IV (1)：TeV and BSM Physics / 526

Study of charm Yukawa couplings at the ATLAS detector

相应作者： tao.wang@mail.ustc.edu.cn

Parallel Session IV (1)：TeV and BSM Physics / 527

Measurement of the Higgs boson mass in the $H \to ZZ^* \to 4l$ decay channel

相应作者： lihan2018@mail.sdu.edu.cn

Parallel Session IV (1)：TeV and BSM Physics / 528

Measurement of boosted VH(bb) process at the ATLAS detector

相应作者： hyc227@mail.ustc.edu.cn

Parallel Session IV (1)：TeV and BSM Physics / 529

Precise Measurements of Z+photon final states and search for anomalous neutral gauge couplings with EFT at ATLAS

相应作者： danningliu@sjtu.edu.cn

Parallel Session V (1)：TeV and BSM Physics / 530

Searches for electroweak production of supersymmetric particles with the ATLAS detector

相应作者： da.xu@cern.ch

Parallel Session V (1)：TeV and BSM Physics / 531

Probing heavy Majorana neutrinos and the Weinberg operator through vector boson fusion processes at the LHC CMS Experiment

Parallel Session VI (1)：TeV and BSM Physics / 532

Measurement of electroweak production of Wgamma with two jets in proton-proton collisions at sqrt(s) = 13 TeV from CMS

Parallel Session VI (1)：TeV and BSM Physics / 533

Search for Higgs boson pair production at CMS

作者： UNKNOWN 王储 [1]

[1] *IHEP*

相应作者： wangchu@ihep.ac.cn

Summary:

Parallel Session VII (1)：TeV and BSM Physics / 534

Flavor Physics at the CEPC

相应作者： lingfeng_li@brown.edu

Parallel Session VII (1)：TeV and BSM Physics / 535

Interplay & synergies between the Cosmic Frontier and CEPC

相应作者： gaoyu@ihep.ac.cn

Parallel Session VII (1)：TeV and BSM Physics / 536

Time of Flight measurement potential at CEPC calorimeter

相应作者： cheyuzhi@ihep.ac.cn

Parallel Session VII (1)：TeV and BSM Physics / 537

New Physics at CEPC

相应作者： zhuangxa@ihep.ac.cn

Parallel Session VII (1)：TeV and BSM Physics / 538

Prospects of electroweakino and slepton search at CEPC

相应作者： jiarong.yuan@mail.nankai.edu.cn

Parallel Session VII (1)：TeV and BSM Physics / 539

Long-Lived Particle Search with Future Lepton Collider

相应作者： mo_cen@sjtu.edu.cn

Parallel Session VIII (1)：TeV and BSM Physics / 540

Recent Higgs measurements in diboson channels at the ATLAS detector

Parallel Session VIII (1)：TeV and BSM Physics / 541

Study of charm Yukawa couplings at the ATLAS detector

相应作者： tao.wang@mail.ustc.edu.cn

Parallel Session VIII (1)：TeV and BSM Physics / 542

Constraining the Higgs boson self-coupling from single- and double-Higgs production with the ATLAS detector using pp collisions at sqrt(s)=13 TeV

相应作者： changqiao.li@sjtu.edu.cn

Summary:

Parallel Session VIII (1)：TeV and BSM Physics / 543

Search for HH−>4b proudction and H−>aa−>4b exotic decays with ATLAS and CEPC

相应作者： wangz1996@sjtu.edu.cn

Parallel Session IX (1)：TeV and BSM Physics / 544

Observation of γγ→ττ in ultraperipheral lead-lead collisions and constraints on g-2 with the ATLAS detector

相应作者： haifeng.li@cern.ch

Parallel Session IX (1)：TeV and BSM Physics / 545

Recent progress in muon electric and magnetic dipole moments

相应作者： kimsiang84@sjtu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 546

Software development and performance studies of New Small Wheel in ATLAS for LHC Run3

作者： Yi Yu[1]

[1] *USTC*

相应作者： yuyi20@mail.ustc.edu.cn

Summary:

Parallel Session X(1)：TeV and BSM Physics / 547

A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery

Parallel Session X(1)：TeV and BSM Physics / 548

Search for Dark Higgs at ATLAS and potential to utilize the Xbb tagger

相应作者： qibin.liu@sjtu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 549

Dark matter searches with jets at ATLAS

Parallel Session X(1)：TeV and BSM Physics / 550

Measurement and Reinterpretation of four-top-quark production cross section with the ATLAS detector in pp collisions at √ s = 13 TeV

Parallel Session X(1)：TeV and BSM Physics / 551

Study of the CP property of the Higgs to vector-boson coupling in the VBF □->□□ channel with the ATLAS detector

作者： Antonio De Maria[1]

[1] *Nanjing University*

相应作者： antonio.de.maria@cern.ch

Summary:

Parallel Session X(1)：TeV and BSM Physics / 552

Search for Higgs boson pair production in □□□□ final state in □□ collisions at √□ = 13 TeV with the ATLAS detector

作者： 子航贾 [1]

[1] *Nanjing University*

相应作者： zihang.jia@cern.ch

Summary:

Parallel Session X(1)：TeV and BSM Physics / 553

Observation of γγ→ττ in ultraperipheral lead-lead collisions and constraints on □ g-2 with the ATLAS detector

相应作者： xinyanliu@mail.sdu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 554

Constraining the Higgs boson self-coupling from single- and double-Higgs production with the ATLAS detector using pp collisions at sqrt(s)=13 TeV

Parallel Session X(1)：TeV and BSM Physics / 555

Measurement of Zgamma plus jets differential cross section using 139 fb-1 data collected by the ATLAS detector

作者： Xuan YANG[1]

[1] 高能所

相应作者： yangxuan@ihep.ac.cn

Summary:

Parallel Session X(1)：TeV and BSM Physics / 556

Search for the direct production of charginos and neutralinos in final states with tau leptons in 13 TeV pp collisions with the ATLAS detector

作者： UNKNOWN 梁诗怡 None

相应作者： liangshy@ihep.ac.cn

Summary:

Parallel Session X(1)：TeV and BSM Physics / 557

A search for heavy Higgs bosons decaying into vector bosons in same-sign two-lepton final states in pp collisions at Ös=13 TeV with the ATLAS detector

相应作者： xuyuell@icloud.com

Parallel Session X(1)：TeV and BSM Physics / 558

Cross terms in the fit function for the precession frequency analysis in the Fermilab Muon g-2 experiment

相应作者： zyh1678783412@sjtu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 559

A Boosted Decision Tree Model for the positron acceptance in the Muon g-2 experiment

相应作者： kimsiang84@sjtu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 560

Muon beam based on GeV electron on target

相应作者： kimsiang84@sjtu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 561

Muon and pion production from electron on target

作者： Meng LvN[one]

合作者： C. Chen ; J. Wang ; Kim Siang Khaw [1]; X. Cai ; Y. Xu

[1] *Shanghai Jiao Tong University*

相应作者： kimsiang84@sjtu.edu.cn

Summary:

Parallel Session X(1)：TeV and BSM Physics / 562

Measurement of Muon Lifetime with Muon g-2 Experiment at Fermilab

Parallel Session X(1)：TeV and BSM Physics / 563

Pileup Background Study with Muon g-2 Experiment at Fermilab

作者： 越恺胡 [1]

[1] *S*

相应作者： karry12345@sjtu.edu.cn

Summary:

Parallel Session X(1)：TeV and BSM Physics / 564

An improved pulse-fitting procedure for calorimeter event reconstruction in the Muon g-2 experiment at Fermilab

Parallel Session X(1)：TeV and BSM Physics / 565

A search for the muon electric dipole moment in the Fermilab Muon g-2 experiment

作者： 天齐胡 [1]

[1] *Shanghai Jiao Tong University*

相应作者： hutianqi@sjtu.edu.cn

Summary:

Parallel Session X(1)：TeV and BSM Physics / 566

Spacer configuration optimization for RPCs based on COMSOL Multiphysics simulation

相应作者： mln517@sjtu.edu.cn

Parallel Session X(1)：TeV and BSM Physics / 567

Dark SHINE——Dark Photon fixed-target search experiment at SHINE Facility

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Parallel Session VII (4)：Neutrino, Astroparticle Physics and Cosmology / 568

Sterile neutrino studies using Daya Bay, MINOS, and Bugey-3 data

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大会闭幕式 / 569

高能物理分会第十一届委员会主任致辞

大会闭幕式 / 570

“晨光杯”颁奖

大会闭幕式 / 571

闭幕式

大会闭幕式 / 572

宣布高能物理分会换届结果

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大会闭幕式 / 573

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Parallel Session X(1)：TeV and BSM Physics / 575

Measurement of mass and width of the Higgs boson at HL-LHC

Parallel Session VIII (4)：Neutrino, Astroparticle Physics and Cosmology / 576

Lastest nH oscillation results from Daya Bay

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大会闭幕式 / 577

致谢，闭幕式