第五届粒子所“青年之星”2019 年度学术论坛

Thursday, 19 December 2019 - Thursday, 19 December 2019

9 号楼

Book of Abstracts

Contents

Morning Session I / 0

Diffusion of charm quarks in jets in high-energy heavy-ion collisions

Author: Sa WANG[1]

Co-authors: Ben-Wei Zhang [2]; Enke Wang [3]; Wei Dai [4]

[1] *CCNU*

[2] *Central China Normal University*

[3] *Inst. of Particle Phys., Huazhong Normal Uni.*

[4] *China University of Geosciences*

The radial distribution of D^0 mesons in jets probes the diffusion of charm quark relative to the jet axis and provides a new perspective to study the interaction mechanisms between heavy quarks and the medium in the nucleus-nucleus collisions. The in-medium parton propagations are described by a Monte Carlo transport model which uses the next-to-leading order (NLO) plus parton shower (PS) event generator SHERPA as input and includes elastic (collisional) and inelastic (radiative) interaction for heavy quarks as well as light partons. At low D^0 meson p_T, the radial distribution significantly shifts to larger radius indicating a strong diffusion effect which is consistent with the recent experimental data. We demonstrate that the angular deviation of charm quarks declines with p_T and is very sensitive to the collisional more than radiative interaction at $p_T < 5$˜GeV. As predictions, we present the D^0 meson radial distribution in jets in p+p and $0-10\%$ Au+Au collisions at $\sqrt{s_{NN}} = 200$˜GeV at the RHIC, and also estimate the nuclear modification factor of charm jet in central Au+Au collisions at 200˜GeV at the RHIC and central Pb+Pb collisions at 5.02˜TeV at the LHC.

Publications:

Eur.Phys.J. C79 (2019) no.9, 789

Presenter:

Sa Wang

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session II / 1

The elliptic flow of open heavy flavor in pA collisions from initial state

Author: Yu Shi[1]

[1] *ccnu*

The azimuthal angular correlation between a heavy-flavor meson (J/Ψ and D^0) and a light hadron has been measured firstly by the CMS experiment. The elliptic flow of J/psi from the initial state has been successful described not long ago. We investigate the angular correlation between a open heavy flavor meson and a charged light hadron in the Color Glass Condensate framework. Our results show that open heavy flavor mesons (D^0 and B) also have a sizable v_2 which has a strong mass dependence. The resulting v_2 of D^0 coincides with recent CMS data. In addition, our prediction for the v_2 of non-prompt D mesons decayed from B mesons perfectly agrees with the recent CMS measurement.

Publications:

Phys.Rev. D99 (2019) no.3, 034009 ; Nucl.Phys. A983 (2019) 293-309; Phys.Rev. D95 (2017) no.11, 116014 ; In preparation.

Presenter:

Yu Shi

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session I / **2**

The characteristics of Loop-node-occupation and its application to network classification

Author: Wenjun Zhang[1]

Co-authors: Wei Li [2]; Weibing Deng [2]

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Loops, which can be found in many different kinds of networks, it is important in many aspects, such as when dealing with spreading dynamics on networks, calculating network dimensions, etc. On the contrary, tree networks in which no loop exits, are simplifications and usually allow for analyticity. There lacks a quantity, however, to tell the ratio of loops which determines the extent of network being close to tree networks. Therefore we introduce the term “Loop Nodes Occupation” (LNO) to describe the ratio of number of nodes belonging to loops to the number of total nodes, and provide an algorithm to calculate LNO. LNO is studied in both network models and real networks. The LNO remains unchanged in different sized ER networks with the same average degree, and increases with the average degree, which yields a critical turning point. The approximate analytical solutions of LNO in ER networks were given, which fits the simulations well. The critical phenomenon is explored by analysing the giant component of networks. We compare the LNO in network models and real networks, and find the latter is generally smaller. The method is also applied to four different kinds of transportation networks and fungal networks, which gives rise to different zones of effect. It is interesting to see that LNO is very useful in network recognition of machine learning.

Publications:

New Journal of Physics

Presenter:

Wenjun Zhang

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session I / **3**

Non-prompt D^0 meson production in pp and Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with ALICE

Author: 文靖张 [1]

[1] 华中师范大学粒子所

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Heavy-flavor quarks (charm and beauty) play an important role in probing the Quark-Gluon Plasma (QGP) formed in the heavy-ion collisions. Due to their heavy masses, charm and beauty quarks are formed in hard scattering processes on a timescale shorter than the QGP formation time at LHC energy. Therefore, they experience all the phases of the medium evolution interacting with the medium constituents and losing energy via collisional and radiative processes. In particular, the mass difference between beauty and charm quarks provides an ideal tool to investigate the predicted mass dependence of parton in-medium energy loss. On this regard, the study of non- prompt D^0-meson production in Pb-Pb collisions provides an indirect measurement of beauty quark production, while the same study in pp collisions, besides, providing the needed reference for Pb-Pb studies, is an excellent tool to investigate perturbative Quantum Chromo Dynamics (pQCD) calculations.

In this talk, the latest results on non-prompt D^0meson production in Pb-Pb and p_{T}-differential cross section in pp collision at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV will be shown.

Publications:

the latest ALICE preliminary results shown in SQM 2019 and QM 2019

Presenter:

Wenjing Zhang

Master Student, PhD Student or Postdoc:

PhD Student

4

Parton Energy Loss and the Generalized Jet Transport Coefficient

Author: Yuanyuan Zhang[1]

Co-authors: Guang-You Qin [1]; Xin-Nian Wang [2]

[1] *Central China Normal University*

[2] *Central China Normal University/Lawrence Berkeley National Laboratory*

We revisit radiative parton energy loss in deeply inelastic scattering (DIS) off a large nucleus within the perturbative QCD approach. We calculate the gluon radiation spectra induced by double parton scattering in DIS without collinear expansion in the transverse momentum of initial gluons as in the original high-twist approach. The final radiative gluon spectrum can be expressed in terms of the convolution of hard partonic parts and unintegrated or transverse momentum dependent (TMD) quark-gluon correlations. The TMD quark-gluon correlation can be factorized approximately as a product of initial quark distribution and TMD gluon distribution which can be used to define the generalized or TMD jet transport coefficient. Under the static scattering center and soft radiative gluon approximation, we recover the result by Gylassy-Levai-Vitev (GLV) in the first order of the opacity expansion. The difference as a result of the soft radiative gluon approximation is investigated numerically under the static scattering center approximation.

Publications:

Phys. Rev. D 100, 074031

Presenter:

Yuanyuan Zhang

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session II / **5**

Parton Energy Loss and the Generalized Jet Transport Coefficient

Author: Yuanyuan Zhang[1]

Co-authors: Guang-You Qin [1]; Xin-Nian Wang [2]

[1] *Central China Normal University*

[2] *Central China Normal University/Lawrence Berkeley National Laboratory*

We revisit radiative parton energy loss in deeply inelastic scattering (DIS) off a large nucleus within the perturbative QCD approach. We calculate the gluon radiation spectra induced by double parton scattering in DIS without collinear expansion in the transverse momentum of initial gluons as in the original high-twist approach. The final radiative gluon spectrum can be expressed in terms of the convolution of hard partonic parts and unintegrated or transverse momentum dependent (TMD) quark-gluon correlations. The TMD quark-gluon correlation can be factorized approximately as a product of initial quark distribution and TMD gluon distribution which can be used to define the generalized or TMD jet transport coefficient. Under the static scattering center and soft radiative gluon approximation, we recover the result by Gylassy-Levai-Vitev (GLV) in the first order of the opacity expansion. The difference as a result of the soft radiative gluon approximation is investigated numerically under the static scattering center approximation.

Publications:

Phys. Rev. D 100, 074031

Presenter:

Yuanyuan Zhang

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session II / **6**

Flavor hierarchy of jet quenching in relativistic heavy-ion collisions

Author: Wen-Jing Xing[1]

Co-authors: Guang-You Qin [1]; Hongxi Xing [2]; Shanshan Cao [3]

[1] *CCNU*

[2] *South China Normal University*

[3] *Wayne State University*

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Relativistic heavy-ion experiments have observed similar quenching effects for (prompt) D mesons compared to charged hadrons for transverse momenta larger than 6-8 GeV, which remains a mystery since heavy quarks typically lose less energies in quark-gluon plasma than light quarks and gluons. Recent measurements of the nuclear modification factors of B mesons and B-decayed D mesons by the CMS Collaboration provide a unique opportunity to study the flavor hierarchy of jet quenching. Using a linear Boltzmann transport model combined with hydrodynamics simulation, we study the energy loss and nuclear modification for heavy and light flavor jets in high-energy nuclear collisions. By consistently taking into account both quark and gluon contributions to light and heavy flavor hadron productions within a next-to-leading order perturbative QCD framework, we obtain, for the first time, a satisfactory description of the experimental data on the nuclear modification factors for charged hadrons, D mesons, B mesons and B-decayed D mesons simultaneously over a wide range of transverse momenta (8-300 GeV). This presents a solid solution to the flavor puzzle of jet quenching and constitutes a significant step towards the precision study of jet-medium interaction. Our study predicts that at transverse momenta larger than 30-40 GeV, B mesons also exhibit similar suppression effects to charged hadrons and D mesons, which may be tested by future measurements.

Reference:

[1] Wen-Jing Xing, Shanshan Cao, Guang-You Qin, and Hongxi Xing, arXiv:1906.00413

Publications:

arXiv:1906.00413

Presenter:

Wen-Jing Xing

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session II / **7**

Light Nuclei (d, t) Production in Au+Au Collisions at $\sqrt{s_{\rm NN}}$=7.7-200 GeV from the STAR experiment

Author: Dingwei Zhang[1]

[1] *CCNU*

Corresponding Author: zhangdingwei@mails.ccnu.edu.cn

In high energy nuclear collisions, light nuclei can be regarded as a cluster of baryons and their yields are sensitive to the baryon density fluctuations. Thus, the production of light nuclei
can be used to study the QCD phase transition, at which the baryon density fluctuation will be enhanced. For example, the ratio of proton ($N(p)$) and triton ($N(t)$) to deuteron ($N(d)$) yields, which is defined as $N(t)\cdot N(p)/N^2(d)$, could be used as a sensitive observable to search for the signature of the 1st order phase transition and/or QCD critical point in heavy-ion collisions [1].

In this talk, we will present the energy and centrality dependence of (anti-)deuteron and triton production in Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 7.7, 11.5, 14.5, 19.6, 27, 39, 54.4, 62.4, and 200 GeV measured by the STAR experiment at RHIC. Especially, the new results from 54.4 GeV high statistics data allow us to examine the previously observed hint of a non-monotonic behavior in the neutron density fluctuations around 20 GeV with much better precision. Further, we will show the beam energy dependence for the coalescence parameter $B_2(d)$ and $B_3(t)$, particle ratios (d/p, t/p, and t/d), and

the yield ratio of $N(t)\cdot N(p)/N^2(d)$. Their physics implications on QCD critical point search and change of equation of state will be discussed.

[1] K. J. Sun, L. W. Chen, C. M. Ko, J. Pu, and Z. Xu, Phys. Lett. B 781, 499 (2018).

Publications:

No

Presenter:

Dingwei Zhang

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session I / 8

Production of D_s meson in Au+Au collision at $\sqrt{s_{NN}}$ = 200 GeV by STAR

Author: 川傅 [1]

Co-author: Shusu Shi [2]

[1] 华中师范大学

[2] *CCNU*

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Charm quarks are excellent probes of properties of Quark-Gluon Plasma (QGP) created in ultra-relativistic heavy-ion collisions.
They are produced before the QGP is created and their thermalization time is comparable to the lifetime of the QGP. Compared to other open charm mesons, D_s mesons are expected to be less sensitive to the interactions in the hadronic phase due to their valence quark compositions. In this talk, we will present results from the STAR experiment on invariant yields of D_s mesons as a function of transverse momentum in Au+Au collision at $\sqrt{s_{NN}}$ = 200 GeV from year 2014 and 2016 data.
The ratio between strange (D_s) and non-strange (D_0) open charm mesons will also be shown, and compared to the PYTHIA and model calculations. A clear enhancement relative to the PYTHIA calculation is seen in the ratio, while model calculations incorporating strangeness enhancement and coalescence hadronization are closer to data. These results suggest that recombination of charm quarks with
equilibrated strange quarks in the QGP plays an important role in charm quark hadronization.

Publications:

No

Presenter:

Chuan Fu

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session I / 9

Extracting jet transport coefficient via single hadron and dihadron productions in high-energy heavy-ion collisions

Authors: Guang-You Qin[1]; Han-Zhong Zhang[2]; Man Xie[1]; Shu-yi Wei[3]

[1] *Central China Normal University*

[2] *ccnu iopp*

[3] *Shandong University*

We study the suppressions of high transverse momentum single hadron and dihadron productions in high-energy heavy-ion collisions based on the framework of a next-to-leading-order perturbative QCD parton model combined with the higher-twist energy loss formalism [1,2]. Our model can provide a consistent description for the nuclear modification factors of single hadron R_{AA} and dihadron I_{AA} in central and non-central nucleus-nucleus collisions at RHIC and the LHC energies.

We quantitatively extract the value of jet quenching parameter $\hat{q}$ via a global χ^2 analysis, and obtain the scaled jet quenching parameter $\hat{q}/T^3 = 4.1 \sim 4.4$ at $T = 378$ MeV for 0.2 TeV Au+Au collisions and $\hat{q}/T^3 = 2.6 \sim 3.3$ at $T = 486$ MeV for 2.76 TeV Pb+Pb collisions, which are consistent with the results from JET Collaboration [3]. We also get the $\hat{q}/T^3 = 2.5$ at $T = 516$ MeV for 5.02 TeV Pb+Pb collisions, $\hat{q}/T^3 = 3.5$ at $T = 469$ MeV for 5.44 TeV Xe+Xe collisions only via single hadron productions and provide the predictions for the dihadron I_{AA} of these two collisions. The above numerical analysis shows that $\hat{q}/T^3$ has some temperature dependence: it decreases as one increases the temperature, which can be understood as decreasing jet-medium interaction strength with increasing temperature.

Here are some other interesting results that the dihadron I_{AA} are typically larger than single hadron R_{AA} given the same nucleus-nucleus collision conditions and the values of I_{AA} also increase as one increases the trigger hadron p_T. These results can be explained by that high p_T single hadrons mainly come from surface bias emission jets, while high p_T dihadrons come from a combination of surfacial and tangential jets as well as punching-through jets [4,5]. And with increasing trigger hadron p_T, the contribution from punching-through jets increases [6]. On average in a A + A event, the total energy loss for jets in the surface bias case is larger than in the case with punching-through jets.

[1] H. Zhang, J. F. Owens, E. Wang and X. N. Wang, Phys. Rev. Lett. 103, 032302 (2009)

[2] X. f. Guo and X. N. Wang, Phys. Rev. Lett. 85, 3591 (2000)

[3] K. M. Burke et al. [JET Collaboration], Phys. Rev. C 90, no. 1, 014909 (2014)

[4] H. Zhang, J. F. Owens, E. Wang and X. N. Wang, Phys. Rev. Lett. 98, 212301 (2007)

[5] J. G. Milhano and K. C. Zapp, Eur. Phys. J. C 76, no. 5, 288 (2016)

[6] H. z. Zhang, J. F. Owens, E. Wang and X.-N. Wang, J. Phys. G 35, 104067 (2008)

Publications:

Eur.Phys.J. C79 (2019) no.7, 589

Presenter:

Xie Man

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session II / 10

Holographic Schwinger effect and the energy loss of quarks in the magnetized background

Author: Zhou-Run Zhu[1]

[1] *Central China Normal University*

Corresponding Author: 337312525@qq.com

We study the magnetic field effect on the Schwinger effect and the energy loss of quarks using the AdS/CFT correspondence. The potential analysis of particle pairs transverse and parallel to the magnetic field is performed in this paper. Firstly, we calculate separating length of the particle pairs at finite temperature with magnetic field. It is found that the maximum value of separating length decreases with the increase of magnetic field and/or temperature , which can be inferred that the virtual electron-positron pairs become real particles more easily . In the further investigation of the effect of magnetic field and temperature, we find the magnetic field and temperature reduce the potential barrier, thus favor the Schwinger effect . When particle pairs are transverse to the magnetic field, the effect of the magnetic field on the Schwinger effect is slightly larger than the parallel case. The difference between the transverse and parallel case becomes smaller with the increase of temperature. It indicates that the high temperature would reduce the anisotropic effect induced by the magnetic field. The effects of a magnetic field on energy loss when moving perpendicular to the magnetic field direction are larger than moving parallel to the magnetic field direction, which implies that the magnetic field tends to suppress more quarks and jets when moving in the transverse direction than in the parallel direction.

Publications:

Phys. Rev. D99, 126001 (2019); arXiv:1912.05806; arXiv:1909.04994.

Presenter:

Zhou-Run Zhu

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session II / 11

Interplaying mechanisms behind inclusive jet R_{AA} and extraction of jet energy loss distributions

Author: Yayun He[1]

[1] *Central China Normal University*

Corresponding Author: heyayun@gmail.com

The observed suppression of inclusive jets in heavy-ion collisions at LHC has a very weak p_T dependence over a large range of p_T = 50-1000 GeV and is almost independent of the colliding energy, though the initial energy density of the formed QGP has increased significantly from $\sqrt{s}$ = 2.76 to 5.02 TeV. This interesting phenomenon is fully investigated in the linear Boltzmann transport(LBT) model for jet propagation combined event-by-event 3+1D hydro backgrounds. We found that the p_T dependence of jet R_{AA} is determined by the initial spectrum in pp collisions and jet quenching. Furthermore, the energy loss distribution is extracted directly from experimental data within a Beyesian method, which provides a model-independent approach to understand jet quenching in detail. The extracted jet energy loss distributions have a scaling behavior and indicate that jet quenching is caused on the average by only a few out-of-cone scatterings.

Publications:

Yayun He, Shanshan Cao, Wei Chen, Tan Luo, Long-Gang Pang, Xin-Nian Wang. Phys. Rev. C 99 (2019) 054911, arXiv:1809.02525. Yayun He, Long-Gang Pang, Xin-Nian Wang. Phys. Rev. Lett. 122 (2019) 252302, arXiv:1808.05310.

Presenter:

Yayun He

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session I / **12**

Locating fixed points in the phase plane

Author: yeyin zhao[1]

Co-author: Yuanfang Wu [2]

[1] *CCNU*

[2] *Central China Normal University*

1.Motivation

2.Description of fixed point

3.Three samples of the potts model

4.locate the fixed point in the phase plane

5.Discuss a possible application at the Beam energy Scan of RHIC

Publications:

Phys.Rev.E 100,052146

Presenter:

zhang yanhua

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session I / **13**

Observation of the Semileptonic D^+ Transition into the $\bar{K}_1(1270)^0$ Axial-Vector Meson

Author: Ke Liu[1]

[1] *CCNU*

Corresponding Author: liuke@ihep.ac.cn

By analyzing a 2.93˜fb^{-1} data sample of e^+e^- collisions,
recorded at a center-of-mass energy of 3.773 GeV with the BESIII detector operated at the BEPCII

collider,
we report the first observation of the semileptonic D^+ transition into the axial-vector meson $D^+ \to \bar{K}_1(1270)^0 e^+ \nu_e$
with a statistical significance greater than 10σ.
Its decay branching fraction is determined to be
$\mathcal{B}[D^+ \to \bar{K}_1(1270)^0 e^+ \nu_e] = (2.30 \pm 0.26^{+0.18}_{-0.21} \pm 0.25) \times 10^{-3}$, where the first and second uncertainties are
statistical and systematic, respectively, and the third originates from the input branching fraction of $\bar{K}_1(1270)^0 \to K^- \pi^+ \pi^0$.

Publications:

Phys. Rev. Lett. 123, 32801 (2019); Phys. Rev. D 97, 052005 (2018)

Presenter:

Ke Liu

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session I / 14

Machine learning of directed percolation

Authors: Jianmin Shen[1]; Wei Li[1]

[1] *CCNU*

In this paper, we apply the supervised learning method in deep learning to study the critical threshold, the spatial and temporal correlation exponent, and also the characteristic times of directed percolation(DP) in both (1+1) and (2+1) dimensions. DP is a classic type of absorbing phase transition in non-equilibrium phase transitions. The previous machine learning method mainly focuses on the equilibrium phase transition such as Ising model, Potts model, XY model. However, studying the non-equilibrium phase transition with a time dimension, we find that the neural network can successfully predict the spatial and temporal correlation exponent of DP model. With the supervised learning method, it is possible to learn and predict the time step t experienced by different size models from the active phase to the absorbing one, and the test accuracy is above 0.9. We also find that (2+1)-dimensional DP can obtain higher test accuracy. This explains the influence of fluctuations in low-dimensional condition on simulation results of the underlying system, which will be weakened by the configurations generated by higher-dimensional models. Furthermore, in the (1+1)-dimensional DP, We can combine configurations of different time steps t into a 2-dimensional image. And the neural network can identify the trend very well. In the case of (2+1) dimensions, the processing method of this work is to flatten $lx * lx$ and then combine it with configurations of different time steps t into a 2-dimensional image. The underlying results suggest that the neural network can still detect its trend and identify the complex pattern.

Publications:

unpublished

Presenter:

申建民

Master Student, PhD Student or Postdoc:

PhD Student

Morning Session II / 15

Measurements of semi-inclusive recoil jet production and modification in pp and PbPb collisions at $\sqrt{s}$ = 5.02 TeV

Author: 煜星党 [1]

[1] 华中师范大学

Corresponding Author: 1165419380@qq.com

The measurement of reconstructed jets over a wide range in jet energy and jet resolution parameter is required for comprehensive understanding of jet quenching in heavy-ion collisions. Such measurements are challenging, however, due to the presence of complex, uncorrelated background to the jet signal, and the need to minimize biases in the selected jet population imposed by background suppression techniques.

In this contribution, we present an approach to measure jets using the semi-inclusive distribution of charged jets recoiling from a high-p_T charged hadron trigger in pp collisions at $\sqrt{s}$ = 5.02 TeV, with emphasis on the region of low recoil jet p_T by taking the advantages of the high statistics collected with ALICE. The semi-inclusive recoil jet measurement provides precise, data-driven suppression of the large uncorrelated background and uniquely enables the exploration of medium-induced modification of jet production over wide phase space, including low T for large jet resolution parameter . Such measurement provides a good test for pQCD calculations, and sets as a reference for jet quenching study in nucleus-nucleus collisions.

Publications:

No

Presenter:

Yuxing Dang

Master Student, PhD Student or Postdoc:

Master Student

Afternoon Session II / 16

Two-photon processes $\gamma\gamma \to \pi^+\pi^-, K^+K^-$ in k_T factorization

Author: 聪王 [1]

Co-author: 俊康何 [1]

[1] 华中师范大学

As one of the simplest hadronic processes, $\gamma\gamma \to M^+M^-$ ($M = \pi, K$) could be a good testing ground for our understanding of the perturbative and nonperturbative structure of QCD, and will be studied with high precision at BELLE-II in the near future. In this paper, we revisit these processes with twist-3 corrections in the perturbative QCD approach based on the k_T factorization theorem, in which transverse degrees of freedom as well as resummation effects are taken into account. The influence of the distribution amplitudes on the cross sections are discussed in detail. Our work shows that not only the transverse momentum effects but also the twist-3 corrections play a significant role in the processes $\gamma\gamma \to M^+M^-$ in the intermediate energy region. Especially in the few GeV region, the twist-3 contributions become dominant in the cross sections. And it is noteworthy that both the twist-3 result of the $\pi^+\pi^-$ cross section and that of the K^+K^- cross section agree well with the BELLE and ALEPH measurements. For the pion and kaon angular distributions, there still exist

discrepancies between our results and the experimental measurements. Possible reasons for these discrepancies are discussed briefly.

Publications:

Eur. Phys. J. C79 (2019) 765

Presenter:

Cong Wang

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session II / 17

Radiative decays of h_c to the light mesons $\eta^{(\prime)}$: A perturbative QCD calculation

Author: 超杰樊 [1]

Co-author: 俊康何 [2]

[1] *CCNU*

[2] 华中师范大学

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We study the radiative decays $h_c \to \gamma\eta^{(\prime)}$ in the framework of perturbative QCD and evaluate analytically the one-loop integrals with the light quark masses kept. Interestingly, the branching ratios $\mathcal{B}(h_c \to \gamma\eta^{(\prime)})$ are insensitive to both the light quark masses and the shapes of $\eta^{(\prime)}$ distribution amplitudes. And it is noticed that the contribution of the gluonic content of $\eta^{(\prime)}$ is almost equal to that of the quark-antiquark content of $\eta^{(\prime)}$ in the radiative decays $h_c \to \gamma\eta^{(\prime)}$. By employing the ratio $R_{h_c} = \mathcal{B}(h_c \to \gamma\eta)/\mathcal{B}(h_c \to \gamma\eta')$, we extract the mixing angle $\phi = 33.8^\circ \pm 2.5^\circ$, which is in clear disagreement with the Feldmann-Kroll-Stech result $\phi = 39.0^\circ \pm 1.6^\circ$ extracted from the ratio $R_{J/\psi}$ with nonperturbative matrix elements $\langle 0 \mid G^a_{\mu\nu}\tilde{G}^{a,\mu\nu} \mid \eta^{(\prime)}\rangle$, but in consistent with $\phi = 33.5^\circ \pm 0.9^\circ$ extracted from the asymptotic limit of the $\gamma^*\gamma - \eta'$ transition form factor and $\phi = 33.9^\circ \pm 0.6^\circ$ extracted from $R_{J/\psi}$ in perturbative QCD. We also briefly discuss possible reasons for the difference in the determinations of the mixing angle.

Publications:

Phys. Rev. D100 (2019) 034005

Presenter:

Chao-Jie Fan

Master Student, PhD Student or Postdoc:

PhD Student

Afternoon Session I / 18

CP asymmetry in $\tau \to K_S\pi\nu_\tau$ decays within the Standard Model and beyond

Author: 丰之陈 [1]

[1] *C*

Corresponding Author: fzchen@mails.ccnu.edu.cn

Motivated by the 2.8σ discrepancy observed between the BaBar measurement and the Standard Model prediction of the CP asymmetry in $\tau \to K_S\pi\nu_\tau$ decays, as well as the prospects of future measurements at Belle II, we revisit this observable in this paper. Firstly, we reproduce the known CP asymmetry due to $K^0 - \bar{K}^0$ mixing by means of the reciprocal basis, which is convenient when a $K_{S(L)}$ is involved in the final state. As the $K\pi$ tensor form factor plays a crucial role in generating a non-zero direct CP asymmetry that can arise only from the interference of vector and tensor operators, we then present a dispersive representation of this form factor, with its phase obtained in the context of chiral theory with resonances, which fulfills the requirements of unitarity and analyticity. Finally, the $\tau \to K_S\pi\nu_\tau$ decays are analyzed both within a model-independent low-energy effective theory framework and in a scalar leptoquark scenario. It is observed that the CP anomaly can be accommodated in the model-independent framework, even at the 1σ level, together with the constraint from the branching ratio of $\tau^- \to K_S\pi^-\nu_\tau$ decay; it can be, however, marginally reconciled only at the 2σ level, due to the specific relation between the scalar and tensor operators in the scalar leptoquark scenario. Once the combined constraints from the branching ratio and the decay spectrum of this decay are taken into account, these possibilities are however both excluded, even without exploiting further the stronger bounds from the (semi-)leptonic kaon decays under the assumption of lepton-flavour universality, as well as from the neutron electric dipole moment and $D - \bar{D}$ mixing under the assumption of $SU(2)$ invariance of the weak interactions.

Master Student, PhD Student or Postdoc:

PhD Student

Publications:

hep-ph/1909.05543 (已经被 PRD 正式接受，目前还没接到 PRD 正式卷标号码)

Presenter:

陈丰之

Afternoon Session I / 19

Measurement of Ξ_c^0 in pp collisions with ALICE at the LHC

Author: Tiantian Cheng[1]

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The ALICE detector at the Large Hadron Collider(LHC) is optimized for the studies of the Quark-Gluon Plasma (QGP) created in heavy-ion collisions. Charm quarks are one of the probes that is extensively used to elucidate the properties of the QGP. They are dominantly produced at the initial stage of the collisions via hard partonic scattering processes and experience the whole evolution of the system. Charm-baryon measurements provide unique insight into hadronisation precesses from the QGP. The baryon-to-meson ratio is expected to be enhanced if charm quarks hadronise via recombination with the surrounding light quarks in the QGP. Moreover, in such a recombination picture, the baryon-to-meson ratio could further be enhanced in the presence of diquark bound states in the QGP. Thus, the measurements of charm baryons could shed light on an unexpected aspect of the QGP. Measurements of charm-baryon production in pp collisions are essential to establish a baseline for Pb–Pb collisions. In addition, the measurements in pp collisions provide critical tests of pQCD calculations and models of charm hadronisation in vacuum. In this talk, the pT differential cross section times branching ratio of the Ξ_c^0 baryon measured in the decay channel $\Xi_c^0 \to e\Xi\nu$ in pp collisions will be reported.

Publications:

no

Presenter:

Tiantian Cheng

Master Student, PhD Student or Postdoc:

Master Student

20

Diffusion of charm quarks in jets in high-energy heavy-ion collisions