

The First International Conference on Axion Physics and Experiment (Axion 2022)

Report of Contributions

Contribution ID: 2

Type: **not specified**

Opening up window of post-inflationary QCD axion

The QCD axion cosmology depends crucially on whether the QCD axion is present during inflation or not. We point out that contrary to the standard criterion, the Peccei-Quinn (PQ) symmetry could remain unbroken during inflation, even when the axion decay constant, f_a , is (much) above the inflationary Hubble scale, H_I . This is achieved through the heavy-lifting of the PQ scalar field due to its leading non-renormalizable interaction with the inflaton, encoded in a high-dimensional operator which respects the approximate shift symmetry of the inflaton. The mechanism opens up a new window for the post-inflationary QCD axion and significantly enlarges the parameter space, in which the QCD axion dark matter with $f_a > H_I$ could be compatible with high-scale inflation and free from constraints on axion isocurvature perturbations. There also exist non-derivative couplings, which still keep the inflaton shift symmetry breaking under control, to achieve the heavy-lifting of the PQ field during inflation.

Additionally, by introducing an early matter domination era, more parameter space of high f_a could yield the observed DM abundance.

Primary author: LI, Lingfeng (Brown University)

Presenter: LI, Lingfeng (Brown University)

Contribution ID: 3

Type: **not specified**

Detecting Axion Dark Matter through the Radio Signal from Omega Centauri

As a well-motivated dark matter candidate, axions can be detected through the axion-photon resonant conversion in the magnetospheres of magnetic white dwarf stars or neutron stars. In this work, we utilize Omega Centauri, which is the largest globular cluster in the Milky Way and is suggested to be the remnant core of a dwarf galaxy, to probe the axion dark matter through radio signals that originate from all the neutron stars and magnetic white dwarf stars in it. With 100 hours of observation, the combination of SKA phase 1 and LOFAR can effectively probe the parameter space of the axion-photon coupling $g_{a\gamma}$ up to $10^{-14} \sim 10^{-15} \text{ GeV}^{-1}$ for the axion mass range of $0.1 \sim 30 \mu\text{eV}$. Depending on the choice of neutron star evolution model, this limitation is two or three and a half orders of magnitude higher than that of the single neutron star or magnetic white dwarf.

Primary authors: Dr WANG, Jin-Wei (TDLI); Prof. YIN, Peng-Fei (IHEP); Prof. BI, Xiao-Jun (IHEP)

Presenter: Dr WANG, Jin-Wei (TDLI)

Contribution ID: 4

Type: **not specified**

Optical circular polarization induced by axion-like particles in blazars

We propose that the interaction between the axion-like particles (ALPs) and photons can be a possible origin of the optical circular polarization (CP) in blazars. Given that there is no deterministic detection of the optical CP at $\sim 0.1\%$ level, a rough limit on ALP-photon coupling can be obtained, specifically $g_{a\gamma} \cdot B_{T0} < 7.9 \times 10^{-12} \text{ G} \cdot \text{GeV}^{-1}$ for $m_a < 10^{-13} \text{ eV}$, depending on the magnetic field configuration of the blazar jet. Obviously, for the blazar models with a larger magnetic field strength, such as hadronic radiation models, this constraint could be more stringent. We also perform a specific analysis for the possible observations of the optical CP in two blazars, namely 3C 66A and OJ 287, and we find that these results could be explained by the ALP-photon mixing with $g_{a\gamma} \sim 10^{-12} \text{ GeV}^{-1}$. As an outlook, our analysis can be improved by further researches on the radiation models of blazars and high-precision joint measurements of the optical CP and linear polarization.

Primary authors: Mr YAO, Runmin (IHEP, CAS); BI, Xiaojun (IHEP, CAS); WANG, Jin-Wei (TDLI); YIN, Peng-fei (IHEP)

Presenter: Mr YAO, Runmin (IHEP, CAS)

Contribution ID: 5

Type: **not specified**

Axion search results in PandaX

Besides WIMPs, axion is also a perfect candidate for dark matter particle. Based on the couplings between axion and electron, solar axion can bombard electrons of xenon, leaving a detectable electron recoil signal. We have achieved a series of axion search based on the PandaX-II data. And in the near future, the new results from PandaX-4T will come.

Primary authors: PANDAX COLLABORATION; 周, 小鹏 (北京航空航天大学)

Presenter: 周, 小鹏 (北京航空航天大学)

Contribution ID: 6

Type: **not specified**

Characterization of massive ALP emissivity from a core-collapse Supernova

ALPs could be copiously emitted during a supernova explosion by means of nuclear processes. The two main processes for axion production in a nuclear medium are nucleon-nucleon Bremsstrahlung $N+N \rightarrow N+N+a$ and pionic Compton-like processes $\pi^+ + p \rightarrow n + a$. The aim of the work is to extend the results already present in the previous literature to the case of massive axions, considering corrections due to finite masses up to 300 MeV. The results obtained, will be exploited to extract the cooling bound on the axion-nucleon coupling g_{aN} in this range of masses. Moreover, this approach enables us to study the effects on emission due to gravitational trapping. Assuming that gravitationally trapped axions decay into photons, we also estimated a bound on their coupling with photons.

Primary authors: Dr LELLA, Alessandro (University of Bari, INFN); Prof. MIRIZZI, Alessandro (University of Bari, INFN); Dr LUCENTE, Giuseppe (University of Bari, INFN); Dr CARENZA, Pierluca (The Oskar Klein Centre, Department of Physics, Stockholm University.)

Presenter: Dr LELLA, Alessandro (University of Bari, INFN)

Contribution ID: 7

Type: **not specified**

Pulsar timing residuals and wideband ultralight dark matter

The coherent oscillation of ultralight dark matter in the mass regime around 10^{-23} eV induces changes in gravitational potential with the frequency in the nanohertz range. This effect is known to produce a monochromatic signal in the pulsar timing residuals. Here we discuss a multifield scenario that produces a wide spectrum of frequencies, such that the ultralight particle oscillation can mimic the pulsar timing signal of stochastic common spectrum process. We discuss how ultralight dark matter with various spins produces such a wide band spectrum on pulsar timing residuals and perform the Bayesian analysis to constrain the parameters. It turns out that the stochastic background detected by NANOGrav can be associated with a wideband ultralight dark matter.

Primary author: Dr ZHANG, Yun-Long (NAOC)

Presenter: Dr ZHANG, Yun-Long (NAOC)

Contribution ID: 8

Type: **not specified**

Axionic Dirac seesaw and electroweak vacuum stability

We explore the connection between tree-level Dirac neutrino masses and axion physics in a scenario where the PQ symmetry enforces lepton number conservation perturbatively. Requiring that the PQ scale f_a is the only heavy scale to play a role in neutrino mass generation, we are led to the construction of a KSVZ-type model where Dirac neutrino masses are inversely proportional to f_a , provided a real scalar triplet (zero hypercharge) is added to the SM scalar sector. We analyse this extended scalar sector, focusing on the stabilisation of the electroweak vacuum. The contribution of the triplet VEV to the W mass may also be responsible for the recent hint of beyond-the-SM physics by the CDF collaboration.

Primary authors: Dr PENEDO, Joao (Lisbon, CFTP); Prof. ZHANG, Xinyi (Hebei University); Prof. REYIMUAJI, Yakefu (Xinjiang University)

Presenter: Prof. ZHANG, Xinyi (Hebei University)

Contribution ID: 9

Type: **not specified**

Axion-photon conversion of LHAASO multi-TeV and PeV photons

The Large High Altitude Air Shower Observatory (LHAASO) has reported the detection of a large number of multi-TeV-scale photon events including also several PeV-scale gamma-ray-photon events with energy as high as 1.4 PeV . The possibility that some of these events may have extragalactic origins is not yet excluded. Here we propose a mechanism for the traveling of very-high-energy (VHE) and ultra-high-energy (UHE) photons based upon the axion-photon conversion scenario, which allows extragalactic above-threshold photons to be detected by observers on the Earth. We show that the axion-photon conversion can serve as an alternative mechanism for the very-high-energy features of the newly observed gamma ray burst GRB 221009A.

Primary authors: MA, Bo-Qiang (Peking University); Mr ZHANG, Guangshuai (Peking University)

Presenter: MA, Bo-Qiang (Peking University)

Contribution ID: 10

Type: **not specified**

QCD axion dark matter and the cosmic dipole anomaly

There is growing evidence that the cosmic dipole measured from the distant galaxy number-count is not consistent with that of CMB and the deviation is getting close to 5σ . We find that the QCD axion, a hypothetical particle originating from the spontaneous breaking of the Peccei-Quinn symmetry, could explain this dipole anomaly if it constitutes the dark matter of our universe. This model requires that the Hubble parameter during inflation should be lower than 10^7 GeV which indicates low scale inflation.

Primary author: 韩, 成成 (Sun Yat-sen University)

Presenter: 韩, 成成 (Sun Yat-sen University)

Contribution ID: 11

Type: **not specified**

Solutions to axion electromagnetodynamics and new search strategies

The Witten effect implies the electromagnetic interactions between axions and magnetic monopoles. Based on the quantum electromagnetodynamics, a generic low-energy axion-photon effective field theory was built by introducing two four-potentials (A^μ and B^μ) to describe a photon. More anomalous axion-photon interactions and couplings (g_{aAA} , g_{aBB} and g_{aAB}) arise in contrary to the ordinary axion coupling $g_{a\gamma\gamma}aF^{\mu\nu}\tilde{F}_{\mu\nu}$. As a consequence, the conventional axion Maxwell equations are further modified. We properly solve the new axion-modified Maxwell equations and obtain the axion-induced electromagnetic fields given a static electric or magnetic field. I will also mention our proposals of new search strategies to measure the new couplings for sub- μeV axion in haloscope experiments.

Primary authors: DAI, Chang-jie; ZHANG, Rui-jia (Nankai University); Dr LI, Tong (Nankai University)

Presenter: ZHANG, Rui-jia (Nankai University)

Contribution ID: 12

Type: **not specified**

Welcome address

Tuesday, 22 November 2022 08:00 (5 minutes)

Presenter: LI, Tianjun

Session Classification: Opening session

Contribution ID: 13

Type: **not specified**

Opening remarks

Tuesday, 22 November 2022 08:05 (10 minutes)

Presenter: ZHOU, Shan-Gui

Session Classification: Opening session

Contribution ID: 14

Type: **not specified**

Opening remarks

Tuesday, 22 November 2022 08:15 (10 minutes)

Presenter: TSAI , Jaw-Shen

Session Classification: Opening session

Contribution ID: 15

Type: **not specified**

Photo

Tuesday, 22 November 2022 08:25 (5 minutes)

Session Classification: Opening session

Contribution ID: 16

Type: **not specified**

Searching for exotic spin dependent interactions by solid-state-spin quantum sensors

Tuesday, 22 November 2022 08:30 (30 minutes)

Presenter: PU HUANG, Jiang-Feng Du/

Session Classification: Morning session I

Contribution ID: 17

Type: **not specified**

Superconducting quantum computer and its future issues

Tuesday, 22 November 2022 09:00 (30 minutes)

Presenter: TSAI, Jaw-Shen

Session Classification: Morning session I

Contribution ID: **18**

Type: **not specified**

Low Energy Effective Theory for Axion Strings

Tuesday, 22 November 2022 09:30 (30 minutes)

Presenter: DINE, Michael

Session Classification: Morning session I

Contribution ID: 19

Type: **not specified**

Bose-Einstein condensation of cold dark matter axions

Tuesday, 22 November 2022 10:00 (30 minutes)

Presenter: SIKIVIE, Pierre

Session Classification: Morning session I

Contribution ID: 20

Type: **not specified**

The open string pair production and its use

Tuesday, 22 November 2022 11:00 (30 minutes)

Presenter: LU, Jian-Xin

Session Classification: Morning session II

Contribution ID: 21

Type: **not specified**

Flavor Structure of Goldstone Bosons

Tuesday, 22 November 2022 11:30 (30 minutes)

Presenter: HE, Xiao-Gang

Session Classification: Morning session II

Contribution ID: 22

Type: **not specified**

Status and prospects of CDEX-go beyond WIMP

Tuesday, 22 November 2022 12:00 (30 minutes)

Presenter: WANG, Qing

Session Classification: Morning session II

Contribution ID: 23

Type: **not specified**

Axion haloscope meets the E field

Tuesday, 22 November 2022 14:00 (30 minutes)

Presenter: GAO, Yu

Session Classification: Afternoon session I

Contribution ID: 24

Type: **not specified**

Quantum interferometry and axion haloscopes

Tuesday, 22 November 2022 14:30 (30 minutes)

Presenter: YANG, Qiaoli

Session Classification: Afternoon session I

Contribution ID: 25

Type: **not specified**

Pulsar timing residuals and wideband ultralight dark matter

Tuesday, 22 November 2022 15:00 (30 minutes)

Presenter: ZHANG, Yun-Long

Session Classification: Afternoon session I

Contribution ID: 26

Type: **not specified**

Light mediator models

Tuesday, 22 November 2022 15:30 (30 minutes)

Presenter: GHOSH, Sumit

Session Classification: Afternoon session I

Contribution ID: 27

Type: **not specified**

Axion minivoids

Tuesday, 22 November 2022 16:30 (30 minutes)

Presenter: O'HARE, Ciaran

Session Classification: Afternoon session II

Contribution ID: **28**

Type: **not specified**

The axion DM mass

Tuesday, 22 November 2022 17:00 (30 minutes)

Presenter: REDONDO, Javier

Session Classification: Afternoon session II

Contribution ID: 29

Type: **not specified**

Opening the QCD Axion Window

Tuesday, 22 November 2022 17:30 (30 minutes)

Presenter: DI LUZIO, Luca

Session Classification: Afternoon session II

Contribution ID: 30

Type: **not specified**

Axion-photon conversion of LHAASO multi-TeV and PeV photons

Wednesday, 23 November 2022 08:30 (30 minutes)

Presenter: MA, Bo-Qiang

Session Classification: Morning session I

Contribution ID: 31

Type: **not specified**

Distinguishing different axion models with low energy couplings

Wednesday, 23 November 2022 09:00 (30 minutes)

Presenter: CHOI, Kiwoon

Session Classification: Morning session I

Contribution ID: 32

Type: **not specified**

Light dark matter

Wednesday, 23 November 2022 09:30 (30 minutes)

Presenter: DUTTA, Bhaskar

Session Classification: Morning session I

Contribution ID: 33

Type: **not specified**

Opening up window of post-inflationary QCD axion

Wednesday, 23 November 2022 10:00 (30 minutes)

Presenter: LI, Lingfeng (Brown University)

Session Classification: Morning session I

Contribution ID: 34

Type: **not specified**

Axion physics at the cosmological collider

Wednesday, 23 November 2022 11:00 (30 minutes)

Presenter: XIANYU, Zhong-Zhi

Session Classification: Morning session II

Contribution ID: 35

Type: **not specified**

QCD axion dark matter and the cosmic dipole anomaly

Wednesday, 23 November 2022 11:30 (30 minutes)

Presenter: HAN, Chengcheng

Session Classification: Morning session II

Contribution ID: 36

Type: **not specified**

Direct and Indirect Probes of Axion with Supernova-scope & Muon g-2

Wednesday, 23 November 2022 12:00 (30 minutes)

Presenter: GE, Shao-Feng (SJTU)

Session Classification: Morning session II

Contribution ID: 37

Type: **not specified**

Searching for axionlike particles with radio observations

Wednesday, 23 November 2022 14:00 (30 minutes)

Presenter: YUAN, Qiang

Session Classification: Afternoon session I

Contribution ID: **38**

Type: **not specified**

Pulsar Polarization Arrays

Wednesday, 23 November 2022 14:30 (30 minutes)

Presenter: REN, Jing

Session Classification: Afternoon session I

Contribution ID: 39

Type: **not specified**

Detecting Axion Dark Matter through the Radio Signal from Omega Centauri

Wednesday, 23 November 2022 15:00 (30 minutes)

Presenter: WANG, Jin-Wei

Session Classification: Afternoon session I

Contribution ID: 40

Type: **not specified**

Optical circular polarization induced by axion-like particles in blazars

Wednesday, 23 November 2022 15:30 (30 minutes)

Presenter: YAO, Runmin

Session Classification: Afternoon session I

Contribution ID: 41

Type: **not specified**

Axion and sub-GeV dark matter searches with CDEX experiment

Wednesday, 23 November 2022 16:30 (30 minutes)

Presenter: LIU, Shu-Kui

Session Classification: Afternoon session II

Contribution ID: 42

Type: **not specified**

Axion search results in PandaX

Wednesday, 23 November 2022 17:00 (30 minutes)

Presenter: ZHOU, Xiao-Peng

Session Classification: Afternoon session II

Contribution ID: 43

Type: **not specified**

Status of the QUAX experiment

Wednesday, 23 November 2022 17:30 (30 minutes)

Presenter: BRAGGIO, Caterina

Session Classification: Afternoon session II

Contribution ID: 44

Type: **not specified**

Subfrequency Portal

Thursday, 24 November 2022 08:30 (30 minutes)

Presenter: LEE, Hye-Sung

Session Classification: Morning session I

Contribution ID: 45

Type: **not specified**

The incredible journey of IBS-CAPP in South Korea towards DFSZ sensitivity

Thursday, 24 November 2022 09:00 (30 minutes)

Presenter: SEMERTZIDIS, Yannis K.

Session Classification: Morning session I

Contribution ID: 46

Type: **not specified**

Searching for axion dark matter via nuclear decay anomalies

Thursday, 24 November 2022 09:30 (30 minutes)

Presenter: HOUSTON, Nick (Beijing University of Technology)

Session Classification: Morning session I

Contribution ID: 47

Type: **not specified**

Lepton-flavor-violating decays into axion-like particles

Thursday, 24 November 2022 11:00 (30 minutes)

Presenter: CALIBBI, Lorenzo

Session Classification: Morning session II

Contribution ID: 48

Type: **not specified**

Seesaw scale as a bridge to axioms

Thursday, 24 November 2022 11:30 (30 minutes)

Presenter: ZHANG, Xinyi

Session Classification: Morning session II

Contribution ID: 49

Type: **not specified**

Opportunities for Axion Searches at Beam Dumps and Stopped Pion Facilities

Thursday, 24 November 2022 12:00 (30 minutes)

Presenter: THOMPSON, Adrian

Session Classification: Morning session II

Contribution ID: 50

Type: **not specified**

Gravitational waves from axion clumps and related direct searches

Thursday, 24 November 2022 14:00 (30 minutes)

Presenter: SUN, Si-Chun

Session Classification: Afternoon session I

Contribution ID: 51

Type: **not specified**

Testing the Newtonian Inverse-Square-Law at Short Ranges

Thursday, 24 November 2022 14:30 (30 minutes)

Presenter: YANG, Shan-Qing

Session Classification: Afternoon session I

Contribution ID: 52

Type: **not specified**

Sapphire: Spin Amplifier for Particle Physics Researches

Thursday, 24 November 2022 15:00 (30 minutes)

Presenter: PENG, Xin-Hua

Session Classification: Afternoon session I

Contribution ID: 53

Type: **not specified**

Searching for exotic spin interactions by ensemble NV centers in diamond

Thursday, 24 November 2022 15:30 (30 minutes)

Presenter: RONG, Xing

Session Classification: Afternoon session I

Contribution ID: 54

Type: **not specified**

Generating and detecting microwave single photons – a review of implementations using superconducting circuits

Thursday, 24 November 2022 16:30 (30 minutes)

Presenter: ZHOU, Yu

Session Classification: Afternoon session II

Contribution ID: 55

Type: **not specified**

Characterization of massive ALP emissivity from a core-collapse Supernova

Thursday, 24 November 2022 17:00 (30 minutes)

Presenter: LELLA, Alessandro (University of Bari, INFN)

Session Classification: Afternoon session II

Contribution ID: 56

Type: **not specified**

Solutions to axion electromagnetodynamics and new search strategies

Thursday, 24 November 2022 17:30 (30 minutes)

Presenter: ZHANG, Rui-jia

Session Classification: Afternoon session II