TDLI-PKU BSM Workshop 2023: Looking to the Sky

Report of Contributions

https://indico-tdli.sjtu.edu.cn/e/1604

Contribution ID: **53** Type: **not specified**

Searching for Evidence of Dark Energy in Milky Way

Wednesday, 2 August 2023 17:00 (20 minutes)

The origin and nature of dark energy is one of the most significant challenges in modern science. This research aims to investigate dark energy on astrophysical scales and provide a cosmology-independent method to measure its equation-of-state parameter w. To accomplish this, we introduce the concept of a perfect fluid in any static, curved spacetime, and express the energy-momentum tensor of the perfect fluid in a general isotropic form, namely Weinberg's isotropic form. This enables us to define an equation-of-state parameter in a physical and global manner. Within this theoretical framework, we demonstrate that the energy-momentum tensor of dark energy on different scales can take the general isotropic form. Furthermore, we explore the SdS_w spacetime and establish its connection with dark energy in cosmology through the equation-of-state parameter w. In the SdS_w spacetime, a repulsive dark force can be induced by dark energy locally. We then apply the concept of the dark force to realistic astrophysical systems using the Poisson equation. Finally, we find that an anomaly in the Milky Way rotation curve can be quantitatively interpreted by the dark force. By fitting the galactic curve, we are able to obtain the value of the equation-of-state parameter of dark energy, independently of specific dark energy models.

Primary author: ZHANG, Rui (IHEP)

Co-author: Dr ZHANG, Zhen (IHEP)

Presenter: ZHANG, Rui (IHEP)

Session Classification: Parallel talks (1)

Contribution ID: **54** Type: **not specified**

pNGB Dark Matter, Cosmic Strings, and Gravitational Waves

Wednesday, 2 August 2023 16:20 (20 minutes)

We propose a UV completion model for pseudo-Nambu-Goldstone dark matter with a hidden U(1) gauge symmetry. Dark matter scattering off nucleons is highly suppressed by the UV scale and direct detection constraints can be easily evaded. The kinetic mixing between the hidden U(1) and the $\mathrm{U}(1)_{\mathrm{Y}}$ gauge fields would lead to dark matter decays. The current bound on the dark matter lifetime implies that the UV scale should be higher than 10^9 GeV. The spontaneous U(1) symmetry breaking at such a high scale would induce cosmic strings with high tension, resulting in a stochastic gravitational wave background with a high energy density. The constraints from current gravitational wave experiments as well as the future sensitivity are investigated. We find that most of the viable parameter points could be well studied in future gravitational wave experiments.

Primary author: Dr YU, Zhao-Huan (Sun Yat-sen University)

Presenter: Dr YU, Zhao-Huan (Sun Yat-sen University)

Session Classification: Parallel talks (1)

Contribution ID: **55** Type: **not specified**

Pathways to proton's stability via naturally small neutrino masses

Wednesday, 2 August 2023 16:40 (20 minutes)

In the present work, the connection between the smallness of the neutrino masses and the stability of the proton is studied. We analyze this connection from different perspectives: the smallness of neutrino mass and the proton stability originate from the same source, small neutrino masses lead to a long lived proton, and the smallness of the proton decay width as a cause of the naturally small neutrino masses. All the schemes are studied in detail and UV realizations are given. We discuss advantages of each scheme and outline further investigation directions.

Primary authors: POPOV, Oleg (Shenzhen MSU-BIT University); Prof. KANG, Sin Kyu (Seoultech)

Presenter: POPOV, Oleg (Shenzhen MSU-BIT University)

Session Classification: Parallel talks (1)

Contribution ID: **56** Type: **not specified**

Nonanalyticity and on-shell factorization of inflation correlators

Wednesday, 2 August 2023 09:00 (35 minutes)

Boundary correlators of dS bulk fields are important theoretical data for QFT in dS, and are also observables of cosmological collider physics. We will present recent progress in understanding the analytic structure of these inflation correlators with massive exchanges at either tree or loop orders. We will explain why the nonanalyticity of Inflation Correlators is phenomenologically important, and how such nonanalyticity can be diagnosed and computed via the on-shell factorization and the corresponding cutting rules.

Primary author: XIANYU, Zhong-Zhi (Tsinghua University)

Presenter: XIANYU, Zhong-Zhi (Tsinghua University)

Session Classification: Contributed talks (1)

Contribution ID: **57** Type: **not specified**

Searching for ultralight dark matter from the sky

Thursday, 3 August 2023 09:00 (35 minutes)

Dark matter (DM) constitutes 26.8% of the entire universe and is one of the most significant mysteries in modern physics. The study of its particle properties is a critical and forefront topic in particle physics and cosmology, unlocking a deeper understanding of the universe and establishing the inherent unity of science.Ultralight dark matter could address small-scale structure problems of the universe, which becomes more and more interesting. So, determining the mass and interaction of such particles remains a formidable challenge. Bosonic particles, such as dark photons and axions, correspond to vector and scalar bosons, respectively, and represent the only option for ultralight DM (≪eV). They offer the most promising avenue of exploration due to their strong theoretical motivations. Also based on the wave-like property of ultralight DM, it can be detected via different kinds of experiments all over the world.

Primary author: WANG, Xiaoping (Beijing University)

Presenter: WANG, Xiaoping (Beijing University)

Session Classification: Contributed talks (2)

Contribution ID: **58** Type: **not specified**

The 21-cm forest as a simultaneous probe of the dark and bright of the universe

Thursday, 3 August 2023 11:15 (35 minutes)

Understanding the nature of dark matter and the first luminous objects of the universe is an indomitable urge of human beings. Various 21 cm signals from neutral hydrogen and various experiments have been proposed, or being used, to unveil the mysteries, but suffering from parameter degeneracies between particle physics and the unknown astrophysics at cosmic dawn. The 21-cm absorption lines from neutral hydrogen against higher-redshift background sources at cosmic dawn, known collectively as the 21-cm forest, are proposed to simultaneously probe the small-scale structures governed by the dark matter particle mass and the early heating history regulated by the formation of first galaxies. By measuring the 1-D power spectrum of the 21-cm forest on high-redshift quasar spectra, the upcoming Square Kilometre Array will be able to shed light on the nature of both the dark matter and the first galaxies.

Primary authors: Dr XU, Yidong (National Astronomical Observatories, CAS); SHAO, Yue; WANG, Yougang; YANG, Wenxiu; LI, Ran; ZHANG, Xin; CHEN, Xuelei

Presenter: Dr XU, Yidong (National Astronomical Observatories, CAS)

Session Classification: Contributed talks (2)

Contribution ID: **59** Type: **not specified**

Millicharged particles from proton bremsstrahlung in the atmosphere

Wednesday, 2 August 2023 10:40 (35 minutes)

Light millicharged particles can be copiously produced from meson decays in cosmic ray collisions with the atmosphere, leading to detectable signals in large underground neutrino detectors. In this paper we study a new channel to produce millicharged particles in the atmosphere, the proton bremsstrahlung process. We find that the proton bremsstrahlung channel can produce a much larger flux of millicharged particles than the previously studied meson decay channel, resulting in an improvement on the SuperK limit by nearly one order of magnitude. Consequently, SuperK can probe new parameter space beyond the current leading limits from ArgoNeuT. We further note that the study on the proton bremsstrahlung process can be extended to other atmospherically produced light particles, and to millicharged particle searches in proton accelerators.

Primary author: LIU, Zuowei

Presenter: LIU, Zuowei

Session Classification: Contributed talks (1)

Contribution ID: **60** Type: **not specified**

Light dark matter around eV mass range

Wednesday, 2 August 2023 09:35 (35 minutes)

I will talk about dark matter in the eV mass range.
The topic includes experimental hints, dark matter theory, and future experimental prospects.

Primary author: YIN, Wen

Presenter: YIN, Wen

Session Classification: Contributed talks (1)

Contribution ID: **61** Type: **not specified**

Detecting High-Frequency Gravitational Waves in Planetary Magnetosphere

Thursday, 3 August 2023 10:40 (35 minutes)

High-frequency gravitational waves (HFGWs) carry a wealth of information on the early Universe with a tiny comoving horizon and astronomical objects of small scale but with dense energy. We demonstrate that the nearby planets, such as Earth and Jupiter, can be utilized as a laboratory for detecting the HFGWs. These GWs are then expected to convert to signal photons in the planetary magnetosphere, across the frequency band of astronomical observation. As a proof of concept, we present the first limits from the existing low-Earth-orbit satellite for specific frequency bands and project the sensitivities for the future more-dedicated detections. The first limits from Juno, the latest mission orbiting Jupiter, are also presented. Attributed to the long path of effective GW-photon conversion and the wide angular distribution of signal flux, we find that these limits are highly encouraging, for a broad frequency range including a large portion unexplored before.

Primary author: REN, Jing (Institute of High Energy Physics)

Presenter: REN, Jing (Institute of High Energy Physics)

Session Classification: Contributed talks (2)

Contribution ID: **62** Type: **not specified**

Dark matter freeze-in gauged $U(1)_{B-3L_i}$ extensions

Thursday, 3 August 2023 13:50 (20 minutes)

We consider a two-step freeze-in mechanism of a singlet fermionic dark matter (DM) χ in a gauged $U(1)_{B-3L_i}$, $i \in \{e, \mu, \tau\}$, extension of the Standard model (SM). The DM communicates with the SM only through flavorful vector-portal Z_{B3L} due to its non-trivial charge x under $U(1)_{B-3L_i}$, which also guarantees the stability of the DM over the age of the Universe for $x \neq \{\pm 3/2, \pm 3\}$. We derive constraints on the gauge coupling g_{B3L} that guarantees to produce the correct observed relic abundance of DM, considering Z_{B3L} to lie within the mass range of a few MeV up to a few GeV. We show, that various current and future proposed intensity frontier experiments will still be able to probe the tiny couplings required for DM freeze-in. Hence, one may be able to see the imprints of non-thermal DM which escaped detection prospects in DM direct searches.

Primary author: MUKHERJEE, Lopamudra (Nankai University)

Presenter: MUKHERJEE, Lopamudra (Nankai University)

Session Classification: Parallel talks (2)

Contribution ID: **63** Type: **not specified**

Search for Ultralight Dark Matter with Space-based Gravitational-Wave Interferometry

Thursday, 3 August 2023 14:10 (20 minutes)

Ultralight particles are well-motivated in many physical theories beyond Standard Model of particle physics. They can also be Dark Matter candidates. If these ultralight fields couple to standard model particles, they would show as additional signals with characteristic features. We show future space-based gravitational-wave interferometry can serve as a sensitive method to detect these light DM and investigate the sensitivity with time-delay interferometry.

Primary author: TANG, Yong (University of Chinese Academy of Sciences)

Presenter: TANG, Yong (University of Chinese Academy of Sciences)

Session Classification: Parallel talks (2)

Contribution ID: **64** Type: **not specified**

Tachyonic Instability Induced Gravitational Waves at the PTA and CMB

Thursday, 3 August 2023 13:30 (20 minutes)

When coupled to massless vector bosons, axion-like particles are known to generate a tachyonic instability as they start to roll down from the potential, which exponentially amplifies the vector boson wave functions. This drastic enhancement will in turn source gravitational waves that may be relevant for various experiments and observations. If the axion-like particles' rolling starts at a cosmic temperature of above MeV, the gravitational waves today will fall in the hunting range of pulsar timing arrays. Even the rolling starts much later, at after the cosmic recombination, the gravitational waves can still leave imprints on the polarizations of the cosmic microwave background. We will discuss the relevant model parameter space and the constraints in the corresponding scenarios.

Primary author: LU, Sida (HKUST)

Presenter: LU, Sida (HKUST)

Session Classification: Parallel talks (2)

Contribution ID: **65** Type: **not specified**

Sphaleron in the Higgs Triplet Model

Thursday, 3 August 2023 14:30 (20 minutes)

The Higgs triplet model (HTM) extends the Standard Model (SM) by one complex triplet scalar (also known as the type-II seesaw model), offering a simple and viable way to account for nonzero neutrino masses. On the other hand, the nontrivial couplings of the triplet to the gauge fields and to the SM Higgs field are expected to influence the topological vacuum structure of the SM and, consequently, the energy and field configuration of the electroweak sphaleron. The sphaleron process plays a crucial role in dynamically generating the baryon asymmetry of the Universe. In this work, we study the vacuum structure of the gauge and Higgs fields and calculate the saddle-point sphaleron configuration in the HTM. The coupled nonlinear equations of motion of the sphaleron are solved using the spectral method. We find that the inclusion of the triplet scalar could, in principle, significantly change the sphaleron energy compared with the SM. Nevertheless, at zero temperature, the current stringent experimental constraint on the vacuum expectation value of the triplet suppresses the difference. Interestingly, we find that there still exists some narrow parameter space where the sphaleron energy can be enhanced by up to 30% compared with the SM case.

Primary authors: YU, Bingrong (IHEP); Mr HU, Jiahang (University of Chinese Academy of Sciences); ZHOU, Shun (IHEP)

Presenter: YU, Bingrong (IHEP)

Session Classification: Parallel talks (2)

Contribution ID: **66** Type: **not specified**

Diagrammatic structures of the Nielsen identity

Thursday, 3 August 2023 14:50 (20 minutes)

The Nielsen identity is crucial for the gauge dependence of various observables associated with the effective potential. Usually when calculated up to a definite order, it is difficult to acquire a gauge-independent result since the incomplete resummation processes. In the literature, Nielsen identity was usually induced through a path-integral way, while the discussions of the gauge-dependence up to a particular perturbative order were uncommon. In this talk, I would like to anatomize the Feynman diagrams to see how this identity works perturbatively. People can anticipate the origin of the perturbative imbalance of this identity through my calculations.

Primary author: TANG, Yi-Lei (中山大学)

Presenter: TANG, Yi-Lei (中山大学)

Session Classification: Parallel talks (2)

Contribution ID: **67** Type: **not specified**

A new first-order QCD phase transition in the early universe and gravitational waves

Wednesday, 2 August 2023 13:30 (35 minutes)

We extend the Standard Model quantum chromodynamics theory (QCD) theory and naturally realize a first-order phase transition at high temperatures above 1 GeV without running into current constraints from both heavy ion colliders and early cosmology. This phase transition is from a non-perturbative effect of the QCD and can have a great impact on the early universe, including gravitational wave signals detectable for future space interferometers.

Primary author: SUN, Sichun (Beijing Institute of Technology)

Presenter: SUN, Sichun (Beijing Institute of Technology)

Session Classification: Contributed talks (1)

Contribution ID: **68** Type: **not specified**

Z portal to the dark sector through Z′ mediation

Thursday, 3 August 2023 16:20 (20 minutes)

The exotic Z decays to a QCD-like dark sector provide unexplored opportunities at colliders. In this talk, we explore the region where the Z portal is generated by a dark Z′. The phenomenological signatures of light Z' are studied, with both dark shower signals in Z decays and rare decays of B hadrons taken into account.

Primary authors: Dr SALVIONI, Ennio (U. Padua); Prof. CHENG, Hsin-Chia (UC Davis); LI, Lingfeng (Brown U.); JIANG, Xuhui (HKUST)

Presenter: JIANG, Xuhui (HKUST)

Session Classification: Parallel talks (3)

Contribution ID: **69** Type: **not specified**

Exploring Ultralight Scalar Assistance in Sterile Neutrino Dark Matter: Cold Spectrum and Unusual X/Gamma-ray Signatures

Thursday, 3 August 2023 16:40 (20 minutes)

We present a scalar-driven sterile neutrino production model where the interaction with the ultralight scalar field modifies the oscillation production of sterile neutrinos in the early universe. The model effectively suppresses the production of sterile neutrinos at low temperatures due to the heavy scalar mass, resulting in a colder matter power spectrum that avoids constraints from small-scale structure observations. In this model, the dominant dark matter relic is from sterile neutrinos, with only a small fraction originating from the ultralight scalar. Furthermore, the model predicts a detectable X/Gamma-ray flux proportional to the cubic density of local sterile neutrinos for a light scalar mass due to the light scalar coupling tosterile neutrinos. This distinguishes our model from normal decaying dark matter, which has a linear dependence on the density. In addition, the model predicts a potential low-energy monochromatic neutrino signal that can be detectable by future neutrino telescopes.

Primary author: 何, 雨轩 (Peking university)

Co-authors: LIU, Jia (Peking University); Mr MA, xiaolin (Peking university); Prof. WANG, xiaoping (beihang university)

Presenter: 何, 雨轩 (Peking university)

Session Classification: Parallel talks (3)

Contribution ID: **70** Type: **not specified**

Majoron Dark Matter from Type II Seesaw

Wednesday, 2 August 2023 14:05 (35 minutes)

The Type II seesaw mechanism is among the simplest extensions of the Standard Model accounting for neutrino masses. These are naturally induced by the vacuum expectation value (vev) of a scalar triplet coupling to the Standard Model Higgs and lepton doublets. In this talk, I will show that the "type-II majoron" - the pseudo Nambu-Goldstone boson that arises in this context if the lepton number is spontaneously broken by the vev of an additional scalar singlet - can naturally account for the dark matter (DM) observed in the universe. I will discuss majoron production in the early universe through both the freeze-in and misalignment mechanism and its signatures and constraints at direct and indirect DM searches.

Primary author: Prof. CALIBBI, Lorenzo

Presenter: Prof. CALIBBI, Lorenzo

Session Classification: Contributed talks (1)

Contribution ID: **71** Type: **not specified**

Neutrino magnetic moment portal: New constraints and multi-messenger opportunities

Wednesday, 2 August 2023 11:15 (35 minutes)

We scrutinize the hypothesis that gauge singlet fermions - sterile neutrinos - interact with Standard Model particles through the transition magnetic moment portal. These interactions lead to the production of sterile neutrinos in supernovae followed by their decay into photons and active neutrinos which can be detected at γ-ray telescopes and neutrino detectors, respectively. We find that the non-observation of active neutrinos and photons from sterile-neutrino decay associated to SN1987A yields the strongest constraints to date on magnetic-moment-coupled sterile neutrinos if their masses are inside a 0.1 – 100 MeV window. Assuming a near-future galactic supernova explosion, we estimate the sensitivity of several present and near-future experiments, including Fermi-LAT, e-ASTROGAM, DUNE, and Hyper-Kamiokande, to magnetic-moment-coupled sterile neutrinos. We also study the diffuse photon and neutrino fluxes produced in the decay of magneticmoment coupled sterile neutrinos produced in all past supernova explosions and find that the absence of these decay daughters yields the strongest constraints to date for sterile neutrino masses inside a 1 – 100 keV window

Primary authors: GOUVˆEA, Andr´e de (Northwestern University); Dr BRDAR, Vedran (CERN); LI, Yingying (USTC); MACHADO, Pedro A. N. (Fermilab)

Presenter: LI, Yingying (USTC)

Session Classification: Contributed talks (1)

Contribution ID: **72** Type: **not specified**

Searching for Ultralight Dark Matter Conversion in Solar Corona using LOFAR Data

Thursday, 3 August 2023 17:00 (20 minutes)

Ultralight axions and dark photons are well-motivated dark matter (DM) candidates. The axion DM and dark photon DM (DPDM) can resonantly convert into electromagnetic (EM) waves in the solar corona when their mass is equal to the solar plasma frequency. The resultant EM waves are mono-chromatic in the radio-frequency range with an energy equal to the DM mass, which can be detected via radio telescopes for solar observations. We search for converted mono-chromatic signals in the observational data of the high-sensitivity Low Frequency Array (LOFAR) telescope. We find the upper limit on the kinetic mixing coupling between DPDM and photon can reach 10^{-13} in the frequency range $30 - 80$ MHz, which is about one order of magnitude better than the existing constraint from the cosmic microwave background (CMB) observation. In addition, we also get the upper limit on the axion-photon coupling in the same frequency range, which is better than the constraints from Light-Shining-through-a-Wall experiments but does not exceed the CAST or other astrophysical bounds.

Primary author: LUO, Yan

Co-authors: AN, Haipeng (Tsinghua University); LIU, Jia (Peking University); GE, Shuailiang (Peking University); Ms CHEN, Xingyao (University of Glasgow)

Presenter: LUO, Yan

Session Classification: Parallel talks (3)

Contribution ID: **73** Type: **not specified**

Probing the dark matter and high-energy particle physics with low-energy neutrino astronomy

Friday, 4 August 2023 09:35 (35 minutes)

The often-considered dark matter (DM) candidates, e.g., WIMP and ALP, are in tension with observations, which motivates new proposals for DM. The recently proposed féeton dark matter, a B-L gauge boson with a small mass and feeble coupling to the standard sector, constitutes a well-motivated dark matter model consistent with cosmology, Seesaw mechanism, and leptogenesis. This model predicts nontrivial neutrino signals decayed from dark matter in the Milky Way and from distant galaxies, which are promising for the future with low-energy neutrino experiments. We name it the féeton dark matter.

Primary authors: LIN, Weikang (South-Western Institute for Astronomy Research); VISINELLI, Luca (Shanghai Jiao Tong University); Prof. XU, Donglian (T D Lee Institute); Prof. YANAGIDA, Tsutomu (TD Lee Institute)

Presenter: LIN, Weikang (South-Western Institute for Astronomy Research)

Session Classification: Contributed talks (3)

Contribution ID: **74** Type: **not specified**

Type II Seesaw leptogenesis

Friday, 4 August 2023 10:40 (35 minutes)

Type II seesaw leptogenesis

Primary author: HAN, Chengcheng (Sun Yat-sen university)

Presenter: HAN, Chengcheng (Sun Yat-sen university)

Session Classification: Contributed talks (3)

Contribution ID: **75** Type: **not specified**

Interactions between several types of cosmic strings

Friday, 4 August 2023 11:15 (35 minutes)

Cosmic strings are line-like topological defects which can be formed in the early universe. In this talk, I first review basic concepts and general features of cosmic strings. Then I will explain how to evaluate interaction energies of two cosmic strings, and discuss our recent results. I also discuss phenomenological implications of our results such as the formation of the bound state of cosmic strings.

Primary author: FUJIKURA, KOHEI (U. Tokyo)

Presenter: FUJIKURA, KOHEI (U. Tokyo)

Session Classification: Contributed talks (3)

Contribution ID: **76** Type: **not specified**

Macroscopic Dark Matter Detection with Extreme Mass Ratio Inspirals and mini-EMRIs

Thursday, 3 August 2023 15:40 (20 minutes)

I will discuss the detection of macroscopic dark matter candidates such as primordial black holes, boson stars, etc, with a special kind of binary system, the extreme mass ratio inspirals, which is a main target for future space-based gravitational wave detectors, and emphasize its advantages in detection of subsolar exotic compact objects. I will also introduce the mini-EMRIs that can be searched for at LIGO.

Primary author: GUO, Huaike (UCAS)

Presenter: GUO, Huaike (UCAS)

Session Classification: Parallel talks (3)

Contribution ID: **77** Type: **not specified**

Dark Conformal Phase Transition and Pulsar Timing Arrays

Thursday, 3 August 2023 16:00 (20 minutes)

We will explore the possibility that the nano-Hz stochastic gravitational wave background recently reported by several Pulsar Timing Arrays is due to a first-order phase transition of a nearly conformal dark sector, using the dual radion effective potential formalism. The dark radiation from the secluded dark sector can alleviate the Hubble tension without violating the $\Delta N_{\rm eff}$ bound, and will be probed by future CMB-S4 experiment. We will also comment on the scenario where the dark sector decays into the visible sector.

Primary authors: FUJIKURA, KOHEI (U. Tokyo); Dr SUZUKI, Motoo (Department of Physics, Harvard University); GIRMOHANTA, Sudhakantha (Tsung-Dao Lee Institute and Shanghai Jiao Tong University); NAKAI, Yuichiro

Presenter: GIRMOHANTA, Sudhakantha (Tsung-Dao Lee Institute and Shanghai Jiao Tong University)

Session Classification: Parallel talks (3)

Contribution ID: **78** Type: **not specified**

Neutron Star Heating: WIMP DM vs Others

Thursday, 3 August 2023 09:35 (35 minutes)

Weakly Interacting Massive Particles (WIMPs) in the Universe accumulate in neutron stars (NSs) through their interactions with ordinary matter, and their annihilation inside the NS core causes late-time heating. It has been argued that this heating effect maintains the surface temperature of old NSs to be a few thousand K, which can be regarded as a smoking gun signature of dark matter (DM) heating in NSs. However, if other heating mechanisms exist, they may hide this effect of the DM heating, making it impossible to search for DM with this strategy. In fact, recent observations suggest that there may be some heating sources in NSs. In this talk, I will review such heating mechanisms and discuss their implications for the DM search using NS temperature observations.

Primary author: Prof. NAGATA, Natsumi

Presenter: Prof. NAGATA, Natsumi

Session Classification: Contributed talks (2)

Contribution ID: **79** Type: **not specified**

TBA

TBA

Primary author: Prof. SHU, Jing

Presenter: Prof. SHU, Jing

Session Classification: Contributed talks (2)

Contribution ID: **80** Type: **not specified**

TBA

Wednesday, 2 August 2023 14:40 (35 minutes)

TBA

Primary author: Prof. HUANG, Qing-guo

Presenter: Prof. HUANG, Qing-guo

Session Classification: Contributed talks (1)

Contribution ID: **81** Type: **not specified**

TBA

Wednesday, 2 August 2023 15:45 (35 minutes)

TBA

Primary author: Prof. LIU, Tao

Presenter: Prof. LIU, Tao

Session Classification: Contributed talks (1)