□□□□□□□□□□□□ - The Fourth Workshop on Frontiers of Particle Physics

Report of Contributions

Contribution ID : **3** Type : **not specified**

A collider test of nano-Hertz gravitational waves from pulsar timing arrays

A cosmic first-order phase transition (FOPT) occurring at MeV-scale provides an attractive explanation for the nano-Hertz gravitational wave (GW) background, which is indicated by the recent pulsar timing array data from the NANOGrav, CPTA, EPTA and PPTA collaborations. We propose this explanation can be further tested at the colliders if the hidden sector couples to the Standard Model sector via the Higgs portal. Through a careful analysis of the thermal history in the hidden sector, we demonstrate that in order to explain the observed GW signal, the portal coupling must be sizable so that it can be probed through Higgs invisible decay at the LHC or future lepton colliders such as CEPC, ILC, and FCC-ee. Our research offers a promising avenue to uncover the physical origin of the nano-Hertz GWs through particle physics experiments.

Primary author(s) : XIE (□), Ke-Pan (□□) (Beihang University)

Co-author(s) : Dr LI, Shao-Ping (IHEP)

Presenter(s) : XIE (□), Ke-Pan (□□) (Beihang University)

Contribution ID : **5** Type : **not specified**

Lepton flavor violation in the B-L symmetric SSM

We mainly investigate the LFV Higgs boson decays $h \to e\mu$, $h \to e\tau$, $h \to \mu\tau$ and $\mu - e$ conversion in nuclei within the B-L symmetric SSM. At the same time, the corresponding constraints from the LFV rare decays $\mu \to e\gamma$, $\tau \to e\gamma$, $\tau \to \mu\gamma$, and muon $(g-2)$ are considered to analyze the numerical results.

Primary author(s) : Dr ZHANG □, Hai-Bin □□ (Hebei University □□□□)

Presenter(s) : Dr ZHANG □, Hai-Bin □□ (Hebei University □□□□)

Contribution ID : **6** Type : **not specified**

Searching for Evidence of Dark Energy in Milky Way

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(s) : ZHANG, Rui (IHEP)

Co-author(s) : Dr ZHANG, Zhen (IHEP)

Presenter(s) : ZHANG, Rui (IHEP)

Contribution ID : **7** Type : **not specified**

Improved the Vacuum Stability Constraints for the GM Model

This talk aims to provide an overview of our recent work on the Georgi-Machacek (GM) model. Firstly, I will give a brief introduction to the GM model. Besides, I will discuss how the GM model and its extension explain the W boson mass anomaly observed in the CDF-II experiment. Further more, I will provide a brief summary of possible extensions to the GM model. At last, I will provide an overview of our latest results regarding the vacuum stability in the GM model.

Primary author(s) : Prof. WANG, Fei (Zhengzhou University)

Co-author(s) : Dr DU, Xiaokang (Henan Academy of Sciences)

Contribution ID : **8** Type : **not specified**

Lightest Higgs boson rare decays in the μ from ν supersymmetric standard model

We study the lightest Higgs boson decays $h \to Z\gamma$, $h \to MZ$ in the μ from ν supersymmetric standard model ($\mu\nu$SSM), where M is a vector meson ($\rho, \omega, J/\psi, \Upsilon$). Compared to the minimal supersymmetric standard model (MSSM), the $\mu\nu$SSM introduces three right-handed neutrino superfields, which lead to the mixing of the Higgs doublets with the right-handed sneutrinos. The mixing affects the lightest Higgs boson mass and the Higgs couplings. In suitable parameter space, the $\mu\nu$SSM can give large new physics (NP) contributions to the signal strengths of $h \to Z\gamma h \to MZ$ and $h \to \gamma\gamma$, which may be detected by a 100 TeV collider or the other future high energy colliders.

Primary author(s) : LIU, ChangXin (HeBei University)

Co-author(s) : ZHANG, Hai-Bin; YANG, Jin-Lei; ZHAO, Shu-Min; FENG, Tai-Fu

Presenter(s) : LIU, ChangXin (HeBei University)

Contribution ID : **9** Type : **not specified**

Long-lived neutral scalar searches at FASER

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.

Primary author(s) : SU, Wei (SYSU)

Contribution ID : **11** Type : **not specified**

Recent Dark Matter combination summary from ATLAS

Ref: https://arxiv.org/abs/2306.00641

Results from a wide range of searches targeting different experimental signatures with and without missing transverse momentum (E_T^{miss}) are used to constrain a Two-Higgs-Doublet Model (2HDM) with an additional pseudo-scalar mediating the interaction between ordinary and dark matter (2HDM+a). The analyses use up to 139 fb^{-1} of proton-proton collision data at a centre-of-mass energy √s = 13 TeV recorded with the ATLAS detector at the Large Hadron Collider between 2015-2018. The results from three of the most sensitive searches are combined statistically. These searches target signatures with large E_T^{miss} and a leptonically decaying Z boson; large E_T^{miss} and a Higgs boson decaying to bottom quarks; and production of charged Higgs bosons in final states with top and bottom quarks, respectively. Constraints are derived for several common as well as new benchmark scenarios within the 2HDM+a.

Primary author(s) : LI, Shu (Tsung-Dao Lee Institute & Shanghai Jiao Tong University); Dr VU, Ngoc Khanh (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Presenter(s) : Dr VU, Ngoc Khanh (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Contribution ID : **12** Type : **not specified**

The Realistic Scattering of Puffy Dark Matter

If dark matter has a finite size, the intrinsic interaction responsible for the structure formation is inevitable from the perspective of dark matter self-scattering. To describe the circumstance in which the binding force realizes the finite size dark protons, we first use the Eikonal approximation to simplify the convoluted scattering between dark protons into the case at the $t = 0$ limit. The Chou-Yang model is then introduced to reduce the number of input parameters to one based on the simplicity and analyticity principle.
A new definition of velocity dependence and the corresponding implications on the small cosmological structures from Chou-Yang dark protons are shown clearly. Even though the parameter space is not fully covered, the numerical findings show that the amplitude coefficient can alter the self-scattering cross-section, allowing us to recover the excluded parameter space without using binding force. Finally, we demonstrate that the correct relic density from thermal freeze-out production prefers super heavy dark protons.
When the dark strong interaction is ignored, we present a comprehensive study on the self-interaction cross-section of puffy dark matter (DM) particles, which have a significant intrinsic size compared to their Compton wavelength.
For such puffy DM self-interaction cross-section in the resonant and classical regimes, our study demonstrates the significance of the Yukawa potential and the necessity of partial wave analysis:
(i) Due to the finite-size effect of puffy DM particles, the new Yukawa potential of puffy DM is found to enlarge the Born-effective regime for the self-interaction cross-section, compared with the point-like DM;
(ii) Our partial wave analysis shows that depending on the value of the ratio between R_χ (radius of a puffy DM particle) and $1/m_\phi$ (force range), the three regimes (Born-effective, resonant and classical) for puffy DM self-interaction cross-section can be very different from the point-like DM;
(iii) We find that to solve the small-scale anomalies via self-interacting puffy DM, the Born-effective and the resonant regimes exist for dwarf galaxies, while for the cluster and Milky Way galaxy the non-Born regime is necessary.

Primary author(s) : XU, Wu-Long (Beijing University of Technology)

Presenter(s) : XU, Wu-Long (Beijing University of Technology)

Contribution ID : **14** Type : **not specified**

Can sub-GeV dark matter coherently scatter on the electrons in the atom?

A novel detection of sub-GeV dark matter is proposed in the paper. The electron cloud is boosted by the dark matter and emits an electron when it is dragged back by the heavy nucleus, namely the coherent scattering of the electron cloud of the atom. The survey in the x-ray diffraction shows that the atomic form factors are much more complex than the naive consideration. The results of the relativistic Hartree–Fock (RHF) method give non-trivial shapes of the atoms. The detailed calculation of the recoil of the electron cloud, the kinetics, the fiducial cross section and the corresponding calculation of detection rate are given analytically. The numerical results show that the limits of the RHF form factors are much more stringent than the recoil of a single electron, almost 4 orders stronger, and also give tight limitations compared to the Migdal effect below about several hundred MeV. The physical picture and the corresponding results are promising and need further exploration.

Primary author(s) : Prof. WANG, Wenyu (□□□□□□)

Presenter(s) : Prof. WANG, Wenyu (□□□□□□)

Contribution ID : **16** Type : **not specified**

Local spacetime effects of dark energy

The mysterious dark energy remains one of the greatest puzzles of modern science. Current detections for it are mostly indirect. The spacetime effects of dark energy can be locally described by the SdSw metric. Understanding these local effects exactly is an essential step towards the direct probe of dark energy. From first principles, we prove that dark energy can exert a repulsive dark force on astrophysical scales, different from the Newtonian attraction of both visible and dark matter. One way of measuring local effects of dark energy is through the gravitational deflection of light. We geometrize the bending of light in any curved static spacetime. First of all, we define a generalized deflection angle, referred to as the Gaussian deflection angle, in a mathematically strict and conceptually clean way. Basing on the Gauss-Bonnet theorem, we then prove that the Gaussian deflection angle is equivalent to the surface integral of the Gaussian curvature over a chosen lensing patch. As an application of the geometrization, we study the problem of whether dark energy affects the bending of light and provide a strict solution to this problem in the SdSw spacetime. According to this solution, we propose a method to overcome the difficulty of measuring local dark energy effects. Exactly, we find that the lensing effect of dark energy can be enhanced by 14 orders of magnitude when properly choosing the lensing patch in certain cases. It means that we can probe the existence and nature of dark energy directly in our Solar System. This points to an exciting direction to help unraveling the great mystery of dark energy.

Primary author(s) : Dr ZHANG, Zhen (Institute of High Energy Physics)

Presenter(s) : Dr ZHANG, Zhen (Institute of High Energy Physics)

Contribution ID : **17** Type : **not specified**

Study of semileptonic decays of B_{(s,c)} in a phenomenological potential model

Using a non-relativistic potential model, we obtain the mass spectra, leptonic decay constants, and parameters of the Isgur-Wise function for the beauty and charm mesons. With the calculated quantities, we investigate purely leptonic decays of B^+, B^*, B_c^+, semileptonic decay modes $B_{(s)} \to D_{(s)} l\nu$ and $B_c \to \eta_c \ell \bar{\nu}$ for three lepton channels e, μ, τ, and obtain the corresponding branching fractions. $\bar{B}_{(s)} \to D^*_{(s)} l\bar{\nu}$ transitions are also studied. Our results are found to be in agreement with those obtained in the experimental and theoretical results.

Primary author(s) : Dr RAHMANI, Sara (Hunan University); Prof. LUO, Wenchen (Central South University); Prof. XIAO, Chuwen (Guangxi Normal University)

Presenter(s) : Dr RAHMANI, Sara (Hunan University)

Contribution ID : **18** Type : **not specified**

No-scale inflation inspired from string theory compactifications

We propose the generic no-scale inflation inspired from string theory compactifications. We consider the renormalizable superpotential of inflaton field φ in general and the Kähler potentials with φ, as well as one, two, and three Kähler moduli. We study the spectral index and tensor-to-scalar ratio in details, and find the viable parameter spaces which are consistent with the Planck and BICEP/Keck experimental data on the cosmic microwave background (CMB). Also, we study the formation of primordial black hole (PBH) dark matter and the generation of scalar induced secondary gravitational waves (SIGWs) in the two-moduli no-scale inflation models by adding an exponential term into the Kähler potential.

Primary author(s) : WU, Lina (Xi'an Technological University)

Presenter(s) : WU, Lina (Xi'an Technological University)

Contribution ID : **20** Type : **not specified**

The electromagnetic decays of X(3823) as the ψ2(1 3D2) state within the Bethe-Salpeter framework

We study the electromagnetic (EM) decays of X(3823) as the $\psi_2(1^3D_2)$ state by using the relativistic Bethe-Salpeter method. Similarly, the EM decay widths of $\psi_2(n^3D_2)$, $n = 2, 3$, are predicted, and we find the dominant decays channels are $\psi_2(n^3D_2) \to \chi_{c1}(nP)\gamma$, where $n = 1, 2, 3$. The wave function include different partial waves, which means the relativistic effects are considered. We also study the contributions of different partial waves.

Primary author(s) : LI, Wei (Hebei University)

Co-author(s) : Prof. WANG, Guo-Li

Presenter(s) : LI, Wei (Hebei University)

Contribution ID : **21** Type : **not specified**

The study of Type II and Type III Seesaw mechanism at muon collider

The future muon collider can play as an ideal machine to search for new physics at high energies. In this work, we study the search potential of the heavy Higgs triplet in the Type II and Type III Seesaw mechanism at muon colliders with high collision energy and high luminosity.

In Type II Seesaw, we show the impact of neutrino mass and mixing parameters on the purely leptonic decays. The pair production of doubly charged Higgs H^{++}H^{−−} is through direct \mu^+\mu^− annihilation and vector boson fusion (VBF) processes at muon collider. The associated production H^{\pm\pm}H^{\mp} can only be induced by VBF processes. We simulate both the purely leptonic and bosonic signal channels of charged Higgs bosons in Type II Seesaw, together with the Standard Model backgrounds. We show the required luminosity for the discovery of the charged Higgses and the reachable limits on the leptonic decay branching fractions.

In Type III Seesaw, we consider the pair production of charged triplet leptons E^+E^- through both μ+μ− annihilation and vector boson fusion (VBF) processes. The leading-order framework of electroweak parton distribution functions are utilized to calculate the VBF cross sections. The charged triplet leptons can be probed for masses above ~ 1 TeV. The E^+E^− \to ZZ\ell^+\ell^− channel can be further utilized to fully reconstruct the three triplet leptons and distinguish neutrino mass patterns. The pair production of heavy neutrinos N and the associated production E^{\pm}N are only induced by VBF processes and lead to lepton-number-violating (LNV) signature. We also study the search potential of LNV processes at future high-energy muon collider with \sqrt{s} = 30 TeV.

Our published work
Type II Seesaw : https://arxiv.org/pdf/2301.07274.pdf
Type III Seesaw: https://arxiv.org/pdf/2205.04214.pdf

Primary author(s) : Dr YAO, Changyuan (Nankai University and Deutsches Elektronen-Synchrotron); Dr QIN, Han (University of Pittsburgh); Dr YUAN, Man (Nankai University); Prof. LI, Tong (Nankai University)

Presenter(s) : Dr YUAN, Man (Nankai University)

Contribution ID : **22** Type : **not specified**

Early kinetic decoupling effect on the forbidden dark matter annihilations into standard model particles

The early kinetic decoupling (eKD) effect is an inevitable ingredient in calculating the relic density of dark matter (DM) for various well-motivated scenarios. It appears naturally in forbidden dark matter annihilation, the main focus of this work, which contains fermionic DM and a light singlet scalar that connects the DM and standard model (SM) leptons. The strong suppression of the scattering between DM and SM particles happens quite early in the DM depletion history, where the DM temperature drops away from the thermal equilibrium, $T_\chi < T_{\rm SM}$, leading to the decreased kinetic energy of DM. The forbidden annihilation thus becomes inefficient since small kinetic energy cannot help exceed the annihilation threshold, naturally leading to a larger abundance. To show the eKD discrepancy, we numerically solve the coupled Boltzmann equations that govern the evolution of DM number density and temperature. It is found that eKD significantly affects the DM abundance, resulting in almost an order of magnitude higher than that by the traditional calculation. We also discuss the constraints from experimental searches on the model parameters, where the viable parameter space shrinks when considering the eKD effect.

Primary author(s) : Dr LIU, Xuewen

Presenter(s) : Dr LIU, Xuewen

Contribution ID : **23** Type : **not specified**

Hybrid origins of the cosmic-ray nuclei spectral hardening at a few hundred GV

The most significant feature in the cosmic-ray (CR) nuclei spectra is the spectral hardening at a few hundred GV. Whether the hardening of the different nuclei species are same or not is important for constructing CR source and propagation models. In this work, we collect the latest released AMS-02 CR nuclei spectra of primary species (proton, helium, carbon, oxygen, neon, magnesium, silicon, and iron), secondary species (lithium, beryllium, boron, and fluorine), and hybrid species (nitrogen, sodium, and aluminum), and study the break positions and the spectral index differences (less and greater than the break rigidity) of the spectral hardening quantitatively. The results show us that the CR nuclei spectral hardening at a few hundred GV has hybrid origins. In detail, the dominating factors of the spectral hardening for primary and secondary CR nuclei species are different: the former comes from the superposition of different kinds of CR sources, while the latter comes from the propagation process. Both of these factors influence all kinds of CR nuclei spectra, just with different weights.

Primary author(s) : NIU, Jia-Shu (Shanxi University)

Presenter(s) : NIU, Jia-Shu (Shanxi University)

Contribution ID : **25** Type : **not specified**

The global B-L symmetry in the flavor-unified theories

I will describe the origin of the global B-L symmetry in the class of SU(N) flavor-unified theories, where the ‘t Hooft anomaly matching and the neutrality conditions play the crucial roles.

Primary author(s) : Mr TENG, Zhaolong; YING-NAN, Mao

Contribution ID : **26** Type : **not specified**

Thermal effects of the freeze-in processes associated with vector bosons

The thermal effects of the vector boson affects the freeze-in processes of the FIMP dark matter. In this talk, utilizing a toy model, I show how we can calculate such processes.

Primary author(s) : TANG, Yi-Lei (□□□□)

Contribution ID : **28** Type : **not specified**

New insights on the supercooling phase transitions

Due to the PTA GW signals, the supercooling phase transitions receive many attentions in recent days. Given the substantial differences in the PT dynamics and bubble evolution, in my opinion it is not well suitable to analyze it just by analogy with the phase transitions that are not supercooled. In the talk we will discuss three issues that require dedicate study for supercooling phase transitions. The status of interpreting the PTA GW signals is also commented.

Primary author(s) : Prof. JIANG, Yun (Sun Yat-sen University)

Co-author(s) : CHEN, Haibin (□□□□); FAN, Qi-Qi (Sun Yat-sen University)

Presenter(s) : Prof. JIANG, Yun (Sun Yat-sen University)

Contribution ID : **29** Type : **not specified**

Higgs Mechanism under the language of on-shell scattering amplitude

In this talk, I will discuss Higgs Mechanism under the language of the on-shell scattering amplitude. 3-point scattering amplitude with massive out-legs can be obtained by the generalized massive spinor helicity method. Higher-point amplitudes can be constructed by lower-point amplitudes according to recursion relation. Different from the description of Field Theory, Higgs mechanism of Spontaneous Symmetry Breaking can be reproduced equivalently by matching of the massless 3-point amplitude in UV limit with the massive 3-point amplitude in IR limit.

Primary author(s) : Dr WANG, You kai (Shaanxi Normal university)

Contribution ID : **31** Type : **not specified**

A modified Koide formula from scalar potential models and from Yukawaon models

In this talk, we will review the Koide formula for charged lepton masses, and its possible explanation based on scalar potential models and from supersymmetric Yukawaon models. We present a modified version of the Koide formula derived from both models. The scalar potential in the scalar potential model or the superpotential in the Yukawaon model is constructed with all terms invariant under symmetries. The resulting Koide's character is modified by two effective parameters, and can fit the experimental mass data of charged leptons, up quarks and down quarks.

Primary author(s) : SUN, Zheng (Sichuan University)

Presenter(s) : SUN, Zheng (Sichuan University)

Contribution ID : **32** Type : **not specified**

Asymmetric dark matter with a spontaneously broken U(1)′: self-interaction and Nano-Hertz gravitational waves

Motivated by the collisionless cold dark matter small scale structure problem, we propose an asymmetric dark matter model with the dark sector charged under a dark U(1)′. The media- tor between dark matter particles is the dark gauge boson, which obtains its mass through the spontaneous breaking of U(1)′. This model easily avoid the strong limits from cosmic microwave background (CMB) observation, and have a large parameter space to be consistent with small scale structure data. Furthermore, this model can explain recent pulsar timing arrays (PTAs) data by a MeV-scale first-order phase transition.

Primary author(s) : Dr ZHANG, Mengchao (Jinan University□□□□□□)

Contribution ID : **33** Type : **not specified**

Singlino DM in the General Mext-to-Minimal Supersymmetric Standard Model

Blablabla…

Primary author(s) : Prof. CAO, Junjie

Presenter(s) : Prof. CAO, Junjie

Contribution ID : **35** Type : **not specified**

A chiral model for sterile neutrinos

A model, which extends the standard model with a new chiral U(1)′ gauge symmetry sector, for the eV-mass sterile neutrino is constructed. It is basically fixed by anomaly free conditions. The lightness of the sterile neutrino has a natural explanation. As a by product, this model provides a WIMP-like dark matter candidate.

Primary author(s) : Prof. LIU, Chun (ITP, CAS)

Presenter(s) : Prof. LIU, Chun (ITP, CAS)

Contribution ID : **36** Type : **not specified**

[illegible]

[illegible]

Primary author(s) : Prof. [illegible], [illegible] ([illegible])

Presenter(s) : Prof. [illegible], [illegible] ([illegible])

Contribution ID : **37** Type : **not specified**

Some New Physics Investigations with Triangular Singularity

A triangular singularity with a loop diagram is the leading Laudau Singularity that features a large number of on-shell particles. We will discuss that BSM models can nicely fit into this paradigm, where hypothetic particles in theories like SUSY and 2HDM are well-positioned to trigger T.S. in a number of processes. At colliders, T.S. will lead to three categories of final-state correlations: anomalous thresholds, two-invariant momenta correlations, and very sharp peaks like those famously seen in hadroscopy studies. We will identify an interesting 'all on-shell' singularity that appears to be missing in the SM Electroweak sector, while it is very easily satisfied in new physics. We also identify a T.S. situation in the t-channel scattering between massive states.

Primary author(s) : Prof. GAO, Yu (IHEP, CAS)

Presenter(s) : Prof. GAO, Yu (IHEP, CAS)

Contribution ID : **40** Type : **not specified**

Can Sterile Neutrino Explain Very High Energy Photons from GRB221009A?

The LHAASO collaboration has reported their observation of very high energy photons (Emax=18TeV) from the gamma-ray burst GRB221009A. The sterile neutrino that involves both mixing and transition magnetic moment may be a viable explanation for these high energy photon events. However, we demonstrate that such a solution is strongly disfavored by the cosmic microwave background (CMB) and Big Bang nucleosynthesis (BBN) in the standard cosmology.

Primary author(s) : Dr □, □□ (□□□□)

Presenter(s) : Dr □, □□ (□□□□)

Contribution ID : **41** Type : **not specified**

Axion-like dark matter from U(1)_L

blablabla...

Primary author(s) : CHAO, Wei (BNU)

Presenter(s) : CHAO, Wei (BNU)

Contribution ID : **42** Type : **not specified**

[redacted]

[redacted]

Primary author(s) : Dr GUO, Huaike ([redacted])

Presenter(s) : Dr GUO, Huaike ([redacted])

Contribution ID : **43** Type : **not specified**

Theoretical Corrections of R_D and R_{D^*}

R_{D^{(}*)}*is the ratio of* \overline{B}->D^{(}*)*\tau\overline{\nu}*{\tau} to* \overline{B}-> D^{(}*)*l\overline{\nu}*{l}. *There is a gap of 2*\sigma*{exp} or more between its experimental value and the SM prediction. People extend the MSSM with the local gauge group U(1)_X to obtain the U(1)_XSSM. Compared with MSSM, U(1)_XSSM has more superfields and effects. In U(1)_XSSM, we research the decays \overline{B} -> D^{(}*)l*\overline{\nu}*{l} and calculate R_{D^{(}*)}*. The obtained numerical results of R_{D^{(}*)} are further corrected under U(1)*X$SSM, which is much better than the SM predictions. After correction, the theoretical value of R*{D^{(*)}} can reach in one \sigma_{exp} range of the averaged experiment central value.

Primary author(s) : Prof. □, □□ (□□□□)

Contribution ID : **44** Type : **not specified**

PTA observations of nHz gravitational waves, collapsing domain walls, and freeze-in dark matter

Evidence for a stochastic gravitational wave background in the nHz frequency band is recently reported by four pulsar timing array collaborations NANOGrav, EPTA, CPTA, and PPTA. It can be interpreted by gravitational waves from collapsing domain walls in the early universe. We assume such domain walls arising from the spontaneous breaking of a Z_2 symmetry in a scalar field theory, where a tiny Z_2-violating potential is required to make domain walls unstable. We propose that this Z_2-violating potential is radiatively induced by a feeble Yukawa coupling between the scalar field and a fermion field, which is also responsible for dark matter production via the freeze-in mechanism. Combining the pulsar timing array data and the observed dark matter relic density, we find that the model parameters can be narrowed down to small ranges.

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

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

Contribution ID : **45** Type : **not specified**

DarkSHINE – a new initiative to search for light dark matter at SHINE facility

Dark SHINE is a newly proposed fixed-target experiment at SHINE (Shanghai high repetition rate XFEL and extreme light facility, being the 1st hard X-ray FEL in China) under construction targeting completion in 2026. Dark SHINE aims to search for the new mediator, Dark Photon, bridging the Dark sector and the ordinary matter. In this work and presentation, we present the idea of this new project and 1st prospective study in search for Dark Photon decaying into light dark matter. It also provides the opportunity to incorporate broader scope of BSM search ideas such as ALP, utilizing the fixed-target experiment of this type.

Primary author(s) : Dr □, □□ (□□□□□□)

Presenter(s) : Dr □, □□ (□□□□□□)

Contribution ID : **46** Type : **not specified**

New analyses of event shapes and the determination of QCD α_s in e^+e^- annihilation

(Based on arXiv:2112.06212; 1908.00060; 1902.01984).
We give comprehensive analyses for event shape observables in electron-positron annihilation by using the Principle of Maximum Conformality (PMC). Conventionally, the renormalization scale and theoretical uncertainties in event shape observables are often evaluated by setting the scale to the center-of-mass energy $\sqrt{s}$. Only one value of the QCD coupling at the single scale $\sqrt{s}$ can be extracted. In contrast, the PMC renormalization scales change with event shape kinematics, and thus yield the correct physical behavior of the scale. The resulting PMC predictions agree with precise event shape distributions measured at the LEP experiment. We can precisely determine the running of the QCD coupling constant $\alpha_s(Q^2)$ over a wide range of Q^2 in perturbative domain from event shape distributions measured at a single center-of-mass energy $\sqrt{s}$.

Primary author(s) : Prof. □, □□ (□□□□□□□)

Presenter(s) : Prof. □, □□ (□□□□□□□)

Contribution ID : **47** Type : **not specified**

A Z_3 symmetric extension to SM: from dark matter to visible matter and gravitational wave

[illegible]Z_3[illegible]

Primary author(s) : Dr [illegible], [illegible] ([illegible])

Presenter(s) : Dr [illegible], [illegible] ([illegible])

Contribution ID : **48** Type : **not specified**

Semileptonic decay of heavy flavor meson in quark model

blablabla…

Primary author(s) : Dr □, □□ (□□□□□□□)

Presenter(s) : Dr □, □□ (□□□□□□□)

Contribution ID : **49** Type : **not specified**

On anisotropies of the cosmological gravitational-wave background from the pulsar timing array observations

Significant evidence for a gravitational-wave background has recently been reported by several Pulsar Timing Array (PTA) observations. In this work, we discuss the anisotropies in the Cosmological Gravitational-Wave Background (CGWB) in a model-independent way, taking the Nanograv 15-year data set as a benchmark. We present the computation of the angular power spectra of CGWB and their cross-correlation with Cosmic Microwave Background (CMB) fluctuations and gravitational lensing. This procedure is applied to signals induced by different early universe processes and is potentially useful for extracting information about CGWB anisotropies from future space-based interferometers and astrometric measurements.

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Axion multi-vacuum and gravitational waves

Axions, being particles beyond the Standard Model, have significant implications in solving fundamental problems like CP violation and serving as dark matter candidates. Given the importance of axions and the multi-vacuum nature of the axion potential, it is crucial to pay attention to the phase transitions occurring in some axion models. In this work, we study the formation and evolution of domains in the axion model, as well as their generation of gravitational wave signals, thereby enriching the methods for testing axion physics.

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