Xiangwei Yin

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Education

2020 – Now **Ph.D. student, Theoretical physics,**
Institute of Theoretical Physics,Chinese Academy of Sciences (ITP-CAS), Beijing, China.

2017 – 2020 **M.Sc. Experimental physics,**
Institute of High Energy Physics, Chinese Academy of Sciences (IHEP-CAS) , Beijing, China.

2013 – 2017 **B.E. Nuclear engineering and technology,**
Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, China.

Research Publications and Scientific Activities

Journal Articles

1. T. Li, J. A. Maxin, D. V. Nanopoulos, and **X. Yin**, "The Right-Handed Slepton Bulk Region for Dark Matter in Generalized No-scale $\mathcal{F}$-$SU(5)$ with Effective Super-Natural Supersymmetry," Oct. 2023. arXiv: 2310.03622 [hep-ph].
2. W. Zhang, T. Li, and **X. Yin**, "The Z resonance, inelastic dark matter, and new physics anomalies in the Simple Extension of the Standard Model (SESM) with general scalar potential," *Eur. Phys. J. C*, vol. 83, no. 8, p. 725, 2023. DOI: 10.1140/epjc/s10052-023-11884-2. arXiv: 2303.14764 [hep-ph].
3. J. Li, T. Nomura, J. Pei, **X. Yin**, and C. Zhang, "Boosting indirect detection of a secluded dark matter sector," *Phys. Rev. D*, vol. 108, no. 3, p. 035 021, 2023. DOI: 10.1103/PhysRevD.108.035021. arXiv: 2302.09839 [hep-ph].
4. T. Li, J. Pei, **X. Yin**, and B. Zhu, "Explanations of the tentative new physics anomalies and dark matter in the Simple Extension of the Standard Model (SESM)," *Nucl. Phys. B*, vol. 998, p. 116 430, 2024. DOI: 10.1016/j.nuclphysb.2023.116430. arXiv: 2205.08215 [hep-ph].
5. T. Li, Q. Xiang, **X. Yin**, and H. Zhou, "Generic U(1)X models inspired from SO(10)," *Phys. Rev. D*, vol. 106, no. 7, p. 075 010, 2022. DOI: 10.1103/PhysRevD.106.075010. arXiv: 2201.03878 [hep-ph].
6. **X.-W. Yin**, T. Hu, B.-X. Yu, and et al., "Precise measurement of attenuation length of the JUNO liquid scintillator," *Radiation Detection Technology and Methods*, vol. 4, pp. 312–318, 2020. DOI: 10.1007/s41605-020-00185-x.

Scientific Activities(Selected)

1. ***2021 MCnet-Beijing Summer School on Monte Carlo Event Generators for High Energy Physics***, Institute of High Energy Physics, CAS, Beijing, China, June 28 - July 2, 2021., 2021.
2. ***The XXVIII International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2021).*** Online, Aug 23 - 28, 2021., 2021.
3. ***International Workshop on High Energy Physics and Cosmology***, online, Aug 16 - 19, 2022., 2022.
4. ***1st International Conference on Axion Physics and Experiment, (AXION 2022)***, online, Nov 22 - 24, 2022., 2022.

5 ***The Second International Conference on Axion Physics and Experiment, (AXION 2023)***, Xi'an,China, Jul 23 - 28, 2023., 2023.

Skills

Languages	English(Fluent), Mandarin Chinese(Native).
Coding	C++, Python, Fortran, Shell script, Perl, Mathematica, LaTeX, MarkDown …
Computer Course	Data Structures and Algorithms, Computer Network, MySQL.
Computer tools in HEP and Cosmology	FeynCalc, SARAH, FeynRules, MadGraph, MicrOMEGAs, SPheno, SuSpect, PTArcade, enterprise, ceffyl, PTMCMC, etc.

Miscellaneous Experience

Awards and Achievements

- 2023 Merit Student in University of Chinese Academy of Sciences, 2023
- 2022 Shu Guang Scholarship of Institute of Theoretical Physics, CAS, 2022
- Merit Student in University of Chinese Academy of Sciences, 2022
- Scholarship for postgraduate students of Chinese Academy of Sciences, 2022
- 2021 Outstanding Volunteer of International Conference on Unification of Supersymmetry and Fundamental Interactions, 2021
- Scholarship for postgraduate students of Chinese Academy of Sciences, 2021
- 2020 Scholarship for postgraduate students of Chinese Academy of Sciences, 2020
- 2019 Scholarship for postgraduate students of Chinese Academy of Sciences, 2019
- 2018 Scholarship for postgraduate students of Chinese Academy of Sciences, 2018
- 2015 Outstanding Student League Leader of Nanjing University of Aeronautics and Astronautics, 2015
- Outstanding Student Leader of Nanjing University of Aeronautics and Astronautics, 2015
- Outstanding Student Scholarship of Nanjing University of Aeronautics and Astronautics,Third prize, 2015
- 2014 Outstanding Student Scholarship of Nanjing University of Aeronautics and Astronautics,Third prize, 2014

References

Prof. Tianjun Li

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Prof. Chaoshang Huang

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Research Plan

The $\mathcal{F}$-$SU(5)$ model

The pursuit of achieving the unification of fundamental interactions has been a long-standing desire. The gauge coupling unification strongly implies the Grand Unified Theory (GUT) and the electroweak unification theory has provided physicists with hope for the GUT. The $SU(5)$ GUT failed with dimension-6 proton decay, exact predication of $sin^2\theta_W$, as well as neutrino masses. One may consider whether supersymmetrical $SU(5)$ can provide a remedy. Actually, with the new Supersymmetry (SUSY) particles contributing to the Renormalization Group Equations (RGEs), the GUT scale is improved in contrast with $SU(5)$, consequently, it increases proton decay lifetime via dimension-6 operator. However, SUSY $SU(5)$ encounters more discomfortable dimension-5 proton decay, notorious doublet-triplet splitting problems, and the exact value of $sin^2\theta_W$, etc. Is there a GUT with minimal particle representations, resolves all the problem mentioned above and is string derivable? It comes to one choice, the $\mathcal{F}$-$SU(5)$. The fruitfulness of $\mathcal{F}$-$SU(5)$ cannot be overemphasized. Our recent work is about the right-handed slepton bulk region, wherein we have natural Dark Matter (DM) as well as right-handed sleptons consistent with the current collider, direct detection, and cosmological constraints, etc. Extremely exciting, the present running LUX-ZEPLIN (1000-day) experiment can probe the whole bulk region parameter space in a few more days. Also, the bulk region of the model can be probed at Future Circular Collider (FCCee) and the Circular Electron-Positron Collider (CEPC), and the dimension-six proton decay is within the reach of the future Hyper-Kamiokande experiment. In the future, more phenomenological potentials of $\mathcal{F}$-$SU(5)$ will be explored.

Gravitational wave

We will investigate the Gravitational Waves (GWs) in the clockwork axion model. The conventional axion decay constant is restricted to the range $10^9 \lesssim f_a \lesssim 10^{12}$ GeV, which is the same order as the Peccei-Quinn (PQ) symmetry breaking scale f. The clockwork mechanism is proposed to split the axion decay constant and PQ symmetry breaking scale. Also, there are some classical solutions and the corresponding topological defects in field theory. For instance, kink solution and domain wall, vortex solution and cosmic string, magnetic monopoles, and instanton, etc. The domain wall and cosmic string which are formed after a phase transition may be important in the evolution of universe. The annihilation of domain walls will produce GWs which can be searched by the Pulsar Timing Arrays (PTAs).

Other new physics models

For the non-SUSY model, we have proposed the Simple Extension of the Standard Model (SESM) which includes four exotic fields and discussed some of the new physics anomalies. For instance, the B physics anomalies, muon g-2, W boson mass, the unitarity constraint, the CP violation and its detection. The splitting of charged and neutral parts of scalar fields can induce the couplings among Z, CP-even, and CP-odd part of scalars, leading to more abundant phenomena in DM annihilation. Maybe in the future, the potential of the SESM will be exhausted.

Research Plan (continued)

Axion physics

- The non-trivial structure of Quantum Chromodynamics(QCD) vacuum requires that QCD Lagrangian should include the CP-violating topological term. This is the infamous strong CP problem. In addition, the pattern also supported by the fact that $U(1)_A$ is not a symmetry of QCD. The PQ mechanism provides an excellent solution of strong CP problem and predicts an axion. We will study the axion model and its detection. For example, we will investigate the axion couplings in light of the CDEX experiment and search for a light mediator via the fifth force.

Inflation

- The No-scale inflation has been widely investigated, thus, we will study the inflationary phenomena in the No-scale $\mathcal{F}$-$SU(5)$ model.

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- I have both experimental and theoretical background. Thus, I am familiar with the experimental hardware (detectors, electronics system), software, and theoretical works. It is worth mentioning that I have great enthusiasm in different topics of particle physics and cosmology. Thus, everything can be done from scratch.