CHEN SUN

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RESEARCH EXPERIENCE

Tel Aviv University 2019 - Present
Postdoctoral Researcher *Tel Aviv, Israel*

Brown University/ KITPC Fellow 2018 - 2019
Joint Research Associate *Providence, USA*

Dartmouth College/ KITPC Fellow 2017 - 2018
Joint Research Associate *Hanover, USA*

EDUCATION

Virginia Tech 2013 - 2017
Ph.D. in Particle Physics, Advisor: Tatsu Takeuchi *Blacksburg, USA*

RESEARCH INTERESTS

Astrophysical constraints of axions

· cosmic distance measurement on axion $a - \gamma$ coupling
· galaxy velocity dispersion on ULDM mass fraction

Finite density in EFT

· EFT study of stellar cooling bounds on light dark matter coupling with electrons

Gravitational wave from BSM sources

· long range force in neutron star binary mergers
· GW probing the shape of ALPs potential

Neutrino phenomenology

· solar neutrino
· supernova neutrino and DUNE

Noncommutative geometry

· Pati-Salam extension from NCG

AWARDS

· Fellowship from the Chinese Academy of Science 2017-2019

· Israel Academy of Sciences and Humanities (IASH)
Foreign Postdoctoral Fellowship from Israel Academy of Science 2019-2021

· Clayton Williams Graduate Fellowship 2015-2016

· Sigma Xi Outstanding Ph.D. Research Award 2015

PUBLICATIONS

An up-to-date list can be found at here

Novel constraints of light dark sector

1. M. A. Buen-Abad, J. Fan, M. Reece, and **CS**, "Challenges for an axion explanation of the muon $g-2$ measurement," arXiv:2104.03267 [hep-ph]
2. J.-F. Fortin, H.-K. Guo, S. P. Harris, D. Kim, K. Sinha, and **CS**, "Axions: From magnetars and neutron star mergers to beam dumps and BECs," *Int. J. Mod. Phys. D* **30** no. 07, (2021) 2130002, arXiv:2102.12503 [hep-ph]
3. M. A. Buen-Abad, J. Fan, and **CS**, "Constraints on Axions from Cosmic Distance Measurements," arXiv:2011.05993 [hep-ph]
4. H.-K. Guo, K. Sinha, **CS**, J. Swaim, and D. Vagie, "Two-Scalar Bose-Einstein Condensates: From Stars to Galaxies," arXiv:2010.15977 [astro-ph.CO]

Gravitational wave probe of light dark sector

5. H.-K. Guo, K. Sinha, and **CS**, "Probing Boson Stars with Extreme Mass Ratio Inspirals," *JCAP* **09** (2019) 032, arXiv:1904.07871 [hep-ph]
6. D. Croon, J. Fan, and **CS**, "Boson Star from Repulsive Light Scalars and Gravitational Waves," *JCAP* **04** (2019) 008, arXiv:1810.01420 [hep-ph]
7. D. Croon, M. Gleiser, S. Mohapatra, and **CS**, "Gravitational Radiation Background from Boson Star Binaries," *Phys. Lett. B* **783** (2018) 158–162, arXiv:1802.08259 [hep-ph]
8. D. Croon, A. E. Nelson, **CS**, D. G. E. Walker, and Z.-Z. Xianyu, "Hidden-Sector Spectroscopy with Gravitational Waves from Binary Neutron Stars," *Astrophys. J. Lett.* **858** no. 1, (2018) L2, arXiv:1711.02096 [hep-ph]

Neutrino probe of BSM

9. S. K. Agarwalla *et al.*, "Constraints on flavor-diagonal non-standard neutrino interactions from Borexino Phase-II," *JHEP* **02** (2020) 038, arXiv:1905.03512 [hep-ph]
10. N. Houston, T. Li, and **CS**, "A new solar neutrino channel for grand-unification monopole searches," *JCAP* **10** (2018) 034, arXiv:1803.02835 [hep-ph]
11. A. Ankowski *et al.*, "Supernova Physics at DUNE," in *Supernova Physics at DUNE*. 8, 2016. arXiv:1608.07853 [hep-ex]

Noncommutative geometry and Pati-Salam

12. U. Aydemir, D. Minic, **CS**, and T. Takeuchi, "B-decay anomalies and scalar leptoquarks in unified Pati-Salam models from noncommutative geometry," *JHEP* **09** (2018) 117, arXiv:1804.05844 [hep-ph]
13. U. Aydemir, D. Minic, **CS**, and T. Takeuchi, "B-decay anomalies and scalar leptoquarks in unified Pati-Salam models from noncommutative geometry," *JHEP* **09** (2018) 117, arXiv:1804.05844 [hep-ph]
14. L. N. Chang, D. Minic, A. Roman, **CS**, and T. Takeuchi, "On the Physics of the Minimal Length: The Question of Gauge Invariance," *Int. J. Mod. Phys. A* **31** (2016) 1630012, arXiv:1602.07752 [hep-th]
15. U. Aydemir, D. Minic, **CS**, and T. Takeuchi, "The 750 GeV diphoton excess in unified $SU(2)_L \times SU(2)_R \times SU(4)$ models from noncommutative geometry," *Mod. Phys. Lett. A* **31** no. 18, (2016) 1650101, arXiv:1603.01756 [hep-ph]
16. L. N. Chang, D. Minic, **CS**, and T. Takeuchi, "Observable Effects of Quantum Gravity," arXiv:1605.04361 [gr-qc]
17. U. Aydemir, D. Minic, **CS**, and T. Takeuchi, "Higgs mass, superconnections, and the TeV-scale left-right symmetric model," *Phys. Rev. D* **91** (2015) 045020, arXiv:1409.7574 [hep-ph]

INVITED TALKS

Hebrew University 2021/05
· Constraints on Axions from Cosmic Distance Measurements

Notre Dame 2021/02
· Constraints on Axions from Cosmic Distance Measurements

U. Oklahoma 2019/05
· Gravitational Wave Signatures of Beyond Standard Model Physics

Neutrino-Electron Scattering at Low Energies Workshop 2019/04
UMass, Amherst
· Constraints on Non-Standard Neutrino Interactions from Borexino Phase-II

Signals of Dark Matter in its Natural Habitat Workshop 2019/02
TRIUMF
· Boson Star from Repulsive Scalars, at LIGO and LISA

Carleton 2018/10
· Particle Phenomenology in the Era of Gravitational Wave Astronomy

Perimeter Institute 2018/10
· Particle Phenomenology in the Era of Gravitational Wave Astronomy

Joint Tufts/MIT Cosmology Seminars 2018/10
MIT
· Boson Star from Repulsive Light Scalars and Gravitational Waves

Queen's University 2018/10
· Particle Phenomenology in the Era of Gravitational Wave Astronomy

McGill 2018/10
· Particle Phenomenology in the Era of Gravitational Wave Astronomy

Stanford 2018/11
· Boson Star from Repulsive Light Scalars and Gravitational Waves

UC Irvine 2018/11
· Boson Star from Repulsive Light Scalars and Gravitational Waves

U. Utah 2018/11
· Boson Star from Repulsive Light Scalars and Gravitational Waves

North-East Cosmology Workshop 2018, McGill University 2018/03
McGill
· New Astrophysical Probes of Beyond SM Physics

Brown University 2017/12
· Gravitational Wave Cosmology & Particle Physics

New England Theoretical Cosmology and Gravity Workshop 2017/10
MIT
· The Limits of Dark Matter from Electroweak Symmetry Breaking

Duke Regional String Meeting 2015/10
Duke University
· Rethinking Gauge Theory through Connes' Noncommutative Geometry

SPOCK meeting 2015/08
University of Cincinnati
· Rethinking Gauge Theory through Connes' Noncommutative Geometry

PROGRAMMING

Languages Python, C, regex, MATLAB, C++
Tools CLASS, MontePython, emcee, micrOMEGAs

CODING PROJECTS

CMB Machine Learning 2021

· simulate CMB maps (gaussian and non-gaussian) at the pixel level
· mask and combine with noise maps from Planck FFP10
· apply neural network for anomaly hunting that gives well-defined statistics

ULDM Galaxy Dispersion 2021

· load and parse SPARC data set
· construct χ^2 estimator and perform Frequentist analysis using `emcee` as a smart grid

SN_RGB (SuperNova Remnant Ghost Buster) 2021

· regex parse Green 2019 catalog, scrapy crawler of simbad database, process of Haslam 408 MHz map
· construct supernova remnant light curve, Gegenschein signal from stimulated decay

Cosmo Axions 2020

· construct axion-photon conversion model inside IGM and ICM
· load and process Pantheon, Bonamente galaxy clusters, BOSS DR12
· perform Bayesian and Frequentist analysis of the result with modified `emcee`

ULDM relaxation solver 2019

· relaxation solver of Bose-Einstein condensate system with two axions
· shooting solver of Bose-Einstein condensate system with one axion, stiffness detection and switch

OUTREACH AND COMMUNITY

Cosmicdicord.net 2019-present

A blog that features backgrounds of my research, fun facts of astroparticle physic, as well as tutorials of simple coding projects.

Women in Science Project (WISP) 2018

Introduction of physics research to female starting undergraduates. Co-mentoring of short term interns from selected groups.

Dartmouth-TRIUMF HEP Tools Bootcamp 2017

Invited authors of computational programs in both high energy physics and cosmology to give online lectures series through the Vidyo platform. The workshop had nearly 200 participants from six continents and received very positive feedback .

REFERENCES

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