Yen-Hsun Lin

Curriculum Vitae

Institute of Physics, Academia Sinica
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Research Summary

I am an astroparticle physicist with expertise in multimessenger astronomy and dark matter (DM) detection. My research focuses on *three key areas*: (1) supernova-neutrino-boosted DM, (2) anomalous heating from DM in compact stars, and (3) probing DM self-interactions and DM-nucleon interactions in stars and planets. The first area is particularly vital as it opens the *new possibility* for direct DM mass measurements using *time-of-flight techniques*. I also collaborate with DUNE/COHERENT members and work on reducing systematic uncertainties in DUNE-like detectors. Additionally, I contributed to the JUNO collaboration, assessing its data analysis to solar-captured DM. My background in astroparticle physics and extensive research experience have provided me with a deep understanding of DM and its broader implications to our Universe.

Topic of Interest

Astroparticle physics, dark matter physics, supernova and compact star physics, high performance computation, Bayesian inference, and Monte Carlo simulation.

Programming

Python, Cython, C++, Mathematica and Matlab.

Education

National Chiao Tung University — Hsinchu, Taiwan
PhD of the Institute of Physics — Aug. 2011 – Jul. 2016
Thesis: Indirect detection of dark matter through neutrinos
Advisor: Prof. Guey-Lin Lin

National Chiao Tung University — Hsinchu, Taiwan
Master of the Institute of Physics (direct to PhD program) — Aug. 2010 – Jul. 2011
Advisor: Prof. Guey-Lin Lin

National Chiao Tung University — Hsinchu, Taiwan
Bachelor of the Department of Electrophysics — Aug. 2006 – Jul. 2010

Experience

Postdoctoral Scholar — Taipei, Taiwan
Institute of Physics, Academia Sinica — Aug. 2023 – Present
Host: Dr. Meng-Ru Wu

Visiting Scholar — Melbourne, Australia
School of Physics, Melbourne University — Oct. 2023 – Nov. 2023
Host: Prof. Nicole F. Bell

Postdoctoral Scholar — Taipei, Taiwan
Physics Division, National Center for Theoretical Sciences — Dec. 2021 – Jul. 2023

Distinguished Postdoctoral Scholar — Taipei, Taiwan
Institute of Physics, Academia Sinica — Aug. 2019 – Dec. 2021
Host: Dr. Meng-Ru Wu

Postdoctoral Researcher — Tainan, Taiwan
Department of Physics, National Cheng Kung University — Oct. 2017 – Jul. 2019
Host: Prof. Chuan-Hung Chen

Honors & Awards

1. **NCTS Postdoc Paper Award** — Taiwan, 2024
   Awarded by the Physics Division, National Center for Theoretical Sciences (NCTS).
2. **Best Research Paper Award for Junior Research Investigator**
   Awarded by the Institute of Physics, Academia Sinica. — Taiwan, 2024
3. **Selected Participant of the 13$^{\text{th}}$ HOPE Meeting with Nobel Laureates**
   Representative of Taiwan. — Japan, 2022
4. **Distinguished Postdoctoral Scholar** — Taiwan, 2019
   Independent position with grant, selected by the Academia Sinica.
5. **Annual Best PhD Thesis in Physical Science** — Taiwan, 2017
   Best PhD Thesis of the year, awarded by the Taiwan Physical Society.
6. **Selected Honorary Member of the Phi Tau Phi Scholastic Society**
   Issued to the student graduated with top score. — Taiwan, 2016

Collaboration Membership

1. With Members of DUNE/COHERENT Collaborations — USA
   - ◇ Collaborating with Dr. Gianluca Petrillo and Dr. Yun-Tse Tsai — 2020 – Present
   - ◇ Analysis the impact due to ν_e-Ar cross section uncertainty
   - ◇ Improving pinched parameter sensitivity via Machine Learning

2. Jiangmen Underground Neutrino Observatory (JUNO) — Jiangmen, China
   - ◇ Co-author of the JUNO Yellow Book (R&D tech notes) — 2015 – 2016
   - ◇ Sensitivity projection for the solar-captured DM in JUNO

Advisees

PhD students

1. **Vo Quang Nhat** Hsinchu, Taiwna
   Institute of Physics, NYCU Aug. 2022 – Jul. 2023
   Co-supervising with Prof. Guey-Lin Lin

2. **Lam Thi To Uyen** Hsinchu, Taiwna
   Institute of Physics, NYCU Aug. 2022 – Jul. 2023
   Co-supervising with Prof. Guey-Lin Lin

Undergraduates

1. **Tsung-Han Tsai** (ASIoP Summer Student Program) Hsinchu, Taiwna
   Department of Physics, NTHU Jul. 2022 – Aug. 2022
   Co-supervising with Dr. Meng-Ru Wu and work published in *Phys. Rev. D* **108**, 083013 (2023). Currently a master student in NTHU.

2. **Yong Sheng Yap** (ASIoP Summer Student Program) Hsinchu, Taiwna
   Department of Physics, NTHU Jul. 2021 – Aug. 2021
   Co-supervising with Dr. Meng-Ru Wu and currently a PhD student in Cambridge University (UK).

3. **Wen-Hua Wu** (ASIoP Summer Student Program) Taipei, Taiwna
   Department of Physics, NTU Jul. 2020 – Aug. 2020
   Co-supervising with Dr. Meng-Ru Wu and work published in *Phys. Rev. Lett.* **130**, 111002 (2023). Currently a PhD student in Rice University (USA).

4. **Adeela Malik** (SLAC Summer Student Program) San Antonio, USA
   Department of Physics, University of Texas at San Antonio Jul. 2020 – Aug. 2020
   Co-supervising with and Prof. Hirohisa Tanaka (SLAC) and Dr. Yun-Tse Tsai (SLAC).

Github Repositories

- `snorer`: ***S*pernova-*N*eutrino-b*O*osted da*R*k matt*ER***
  Description: Evaluating the time-of-flight signatures of boosted dark matter due to supernova neutrinos from Milky Way, SN1987a and arbitrary distant galaxy.
  Role: Main developer and maintainer
  Project Page: `https://github.com/yenhsunlin/snorer`

- `dukes`: ***D*iff*U*se-boosted dar*K* matt*E*r by *S*upernova neutrinos**
  Description: Evaluating the signatures of diffuse boosted dark matter by supernova neutrinos in the early Universe.
  Role: Main developer and maintainer
  Project Page: `https://github.com/yenhsunlin/dukes`

- `dynesor`: ***DY*namical *NE*sted *S*ampling integrat*OR***
  Description: MCMC integrator for evaluating multidimensional integration based on dynamical

nested sampling.
Role: Main developer and maintainer
Project Page: Non-disclose.

Scientific Activities & Services

Workshop organization

- Organizer of the Mini-workshop on Novel Experimental and Astrophysical Probes for Dark Matter, Taipei, Taiwan, 2021

Journal referee

1. Physical Letter B
2. Annals of Physics

Publication List

Refereed Articles

Dagger (†) and asterisk (∗) indicate *first author* and *corresponding author*, respectively. Otherwise, the author list is arranged alphabetically.

1. **Y.-H. Lin**[†,∗] and M.-R. Wu, *Supernova-neutrino-boosted dark matter from all galaxies*, *Phys. Rev. Lett.* **133**, 111004 (2024) [arXiv:2404.08528]

2. **Y.-H. Lin**[†,∗], T.-H. Tsai, G.-L. Lin, H. T.-K. Wong and M.-R. Wu, *Signatures of afterglows from light dark matter boosted by supernova neutrinos in current and future large underground detectors*, *Phys. Rev. D* **108**, 083013 (2023) [arXiv:2307.03522]

3. **Y.-H. Lin**[†,∗], W.-H. Wu, M.-R. Wu and H. T.-K. Wong, *Searching for afterglow: Light dark matter boosted by supernova neutrinos*, *Phys. Rev. Lett* **130**, 111002 (2023) [arXiv:2206.06864]

4. A. Bauswein, G. Guo, J.-H. Lien, **Y.-H. Lin** and M.-R. Wu, *Compact dark objects in neutron star mergers*, *Phys. Rev. D* **107**, 083002 (2023) [arXiv:2012.11908]

5. G.-L. Lin and **Y.-H. Lin**[∗], *Exploring dark sector parameters in light of neutron star temperatures*, *Phys. Rev. D* **104**, 063021 (2021) [arXiv:2102.11151]

6. G.-L. Lin and **Y.-H. Lin**[∗], *Analysis on the black hole formations inside old neutron stars by isospin-violating dark matter with self-interaction*, *JCAP* **08**, 022 (2020) [arXiv:2004.05312]

7. C.-S. Chen and **Y.-H. Lin**[∗], *Reheating neutron stars with the annihilation of self-interacting dark matter*, *JHEP* **08**, 069 (2018) [arXiv:1804.03409]

8. C.-S. Chen and **Y.-H. Lin**[∗], *On the evolution process of two-component dark matter in the Sun*, *JHEP* **04**, 074 (2018) [arXiv:1802.06956]

9. C.-H. Chen and **Y.-H. Lin**, *Study of* $B_c^{\pm} \to (D^0 K^{\pm}, D^0 \pi^{\pm})$ *decays*, arXiv:1710.05531

10. C.-S. Chen, G.-L. Lin, **Y.-H. Lin** and F. Xu, *The 17 MeV anomaly in beryllium decays and* $U(1)$ *portal to dark matter*, *Int. J. Mod. Phys. A* **32**, 1750178 (2017) [arXiv:1609.07198]

11. C.-S. Chen, G.-L. Lin and **Y.-H. Lin**, *Thermal transport of the solar captured dark matter and its impact on the indirect dark matter search*, *Phys. Dark Univ.* **14**, 35 (2016) [arXiv:1508.05263]

12. F. An *et al.* [JUNO Collaboration], *Neutrino Physics with JUNO*, *J. Phys. G* **43**, 1 (2016) [arXiv:1507.05613]

13. C.-S. Chen, G.-L. Lin and **Y.-H. Lin**, *Complementary test of the dark matter self-interaction by direct and indirect detections*, *JCAP* **01**, 013 (2016) [arXiv:1505.03781]

14. Z. Djurcic *et al.* [JUNO Collaboration], *JUNO conceptual design report*, arXiv:1508.07166

15. G.-L. Lin, **Y.-H. Lin** and F.-F. Lee, *Probing the coupling of heavy dark matter to nucleons by detecting neutrino signature from the Earth core*, *Phys. Rev. D* **91**, 033002 (2015) [arXiv:1409.3094]

16. C.-S. Chen, F.-F. Lee, G.-L. Lin and **Y.-H. Lin**, *Probing dark matter self-interaction in the Sun with IceCube-PINGU*, *JCAP* **10**, 049 (2014) [arXiv:1408.5471]

Conference Proceedings

1. G.-L. Lin and **Y.-H. Lin**, *Exploring dark sector parameters in light of neutron star temperatures*, *PoS* ICHEP2022 106 (2022)

2. Lam T. T. Uyen, G.-L. Lin and **Y.-H. Lin**, *Constraints on lepton-flavor-violating scalar portal using the Belle II result in the search for* $e^+e^- \to e^\pm +$*invisible with* $L = 276\ pb^{-1}$, *PoS* ICHEP2022 1229 (2022)

3. **Y.-H. Lin** and G.-L. Lin, *Analysis on the black hole formations inside old neutron stars by isospin-violating dark matter with self-interaction*, *PoS* ICHEP2020 598 (2020)

4. **Y.-H. Lin** and G.-L. Lin, *Probing self-interacting dark matter through neutron stars*, *PoS* EPS-HEP2019 075 (2020)

5. C.-S. Chen, G.-L. Lin **Y.-H. Lin** and F. Xu, *The 17 MeV anomaly in beryllium decays and* $U(1)$ *portal to dark matter*, *PoS* EPS-HEP2017 627 (2017)

6. C.-S. Chen, **Y.-H. Lin** and G.-L. Lin, *Complementary test of the dark matter self-interaction in dark* $U(1)$ *model by direct and indirect detection*, *JPS Conf.Proc.* **14**, 020103 (2017)

7. **Y.-H. Lin**, C.-S. Chen and G.-L. Lin, *Thermal transport of the solar captured dark matter and its implication*, *JPS Conf.Proc.* **14**, 020110 (2017)

8. C.-S. Chen, G.-L. Lin and **Y.-H. Lin**, *Probing dark matter self-interaction in the Sun with IceCube-PINGU*, *PoS* FPC2015, 065 (2015)

9. **Y.-H. Lin**, C.-S. Chen and G.-L. Lin, *Thermal transport of the solar captured dark matter and its implication*, *PoS* EPS-HEP2015, 385 (2015)

10. C.-S. Chen, F.-F. Lee, G.-L. Lin and **Y.-H. Lin**, *The dark matter self-interaction and its impact on the critical mass for dark matter evaporations inside the Sun*, *Nucl.Part.Phys.Proc.* **273-252**, 347-375 (2016)

Presentations

Invited Conference/Workshop Talks

1. *Detection of SNν BDM in current and future large underground detectors*
   The 3$^{\text{rd}}$ International Joint Workshop on the Standard Model and Beyond and the 11$^{\text{th}}$ KIAS Workshop on Particle Physics and Cosmology, Jeju, Republic of Korea (2023/11)

2. *Searching for afterglow: Light dark matter boosted by supernova neutrinos*
   Interplay of Nuclear, Neutrino and BSM Physics at Low-Energies (INT 23–85w), Seattle, USA (2023/4)

3. *Light DM constraints from neutron stars and supernova neutrinos*
   Theory Meets Experiment: Particle Physics and Cosmology, Quy Nhon, Vietnam (2023/1)

4. *Light DM constraints from neutron stars and supernova neutrinos*
   NCTS Annual Theory Meeting, Taipei, Taiwan (2022/12)

5. *Light dark matter boosted by supernova neutrinos*
   Dark Matter in Compact Objects, Stars, and in Low Energy Experiments (INT 22–2b), Seattle, USA (2022/8)

6. *Searching the afterglow from supernova neutrino boosted dark matter*
   Particle Physics Phenomenology Workshop (PPP 14), Taipei, Taiwan (2022/6)

7. *Exploring dark matter with compact stars*
   Mini-workshop on Novel Experimental and Astrophysical Probes for Dark Matter, Taipei, Taiwan (2021/3)

8. *Probing the isospin violation of self-interacting dark matter through old neutron stars*
   NCTS Annual Theory Meeting, Taipei, Taiwan (2019/12)

9. *Probing self-interacting dark matter through neutron stars*
   Particle Physics Phenomenology Workshop (PPP 13), Taipei, Taiwan (2019/6)

Contributed Conference/Workshop Talks

1. *Searching light dark matter boosted by supernova neutrinos in Super-K, Hyper-K and DUNE*
   International Conference on Topics in Astroparticle and Underground Physics (TAUP 2023), Vienna, Austria (2023/8)

2. *Detection of afterglows from supernova-neutrino boosted dark matter in large underground detectors*
   International Summer Institute on Phenomenology of Elementary Particle Physics and Cosmology, Nantou, Taiwan (2023/8)

3. *Analysis on the black hole formations inside old neutron stars by isospin-violating dark matter with self-interaction*
   International Conference on High Energy Physics (ICHEP 2020), Prague, Czech Republic (2020/8)

4. *The art of inference: Practicing Bayesian reasoning in computer vision problems*
   PyCon TW, Taipei, Taiwan (2019/9)

5. *Probing self-interacting dark matter through neutron stars*
   European Physical Society Conference on High Energy Physics (EPS-HEP 2019), Ghent, Belgium (2019/7)

6. *On the evolution process of two-component dark matter in the Sun*
   International Conference on Neutrino Physics and Astrophysics (Neutrino 2018), Heidelberg, Germany (2018/6)

7. *Thermal transport of the solar captured dark matter and its implication*
   International Symposium on Nuclei in the Cosmos (NIC-XIV), Niigata, Japan (2016/6)

8. *Thermal transport of the solar captured dark matter and its implication*
   European Physical Society Conference on High Energy Physics (EPS-HEP 2015), Vienna, Austria (2015/7)

9. *The dark matter self-interaction and its impact on the critical mass for dark matter evaporations inside the Sun*
   International Conference on High Energy Physics (ICHEP 2014), Valéncia, Spain (2014/7)

10. *Probing the coupling of heavy dark matter to nucleons by detecting neutrino signature from the Earth core*
    International Symposium on Particles, Strings and Cosmology (PASCOS 2014), Taipei, Taiwan (2013/12)

11. *Probing the coupling of heavy dark matter to nucleons by detecting neutrino signature from the Earth core*
    International Symposium on Cosmology and Particle Astrophysics (CosPA 2013), Honolulu, Hawaii (2013/6)

Seminars & Colloquia

1. *Behind the veil of darkness: A journey into the Uncharted Universe*
   Colloquium for the Department of Physics, Tunghai University, Taichung, Taiwan (2024/5)

2. *Exploring light dark matter boosted by supernova neutrinos in the present and past Universe*
   Seminar for the Department of Physics, National Tsing Hua University, Hsinchu, Taiwan (2024/5)

3. *Signatures of afterglows from light dark matter boosted by supernova neutrinos in large underground detectors*
   Seminar for the Theoretical Particle Physics (TPP) Group, School of Physics, Melbourne University, Melbourne, Australia (2023/10)

4. *Search for afterglow: Light dark matter boosted by supernova neutrino*
   Seminar for the Department of Physics, National Tsing Hua University, Hsinchu, Taiwan (2023/5)

5. *Search for afterglow: Light dark matter boosted by supernova neutrino*
   Seminar for the Department of Physics, Chung Yuan Christian University, Taoyuan, Taiwan (2023/3)

6. *Search for afterglow: Light dark matter boosted by supernova neutrino*
   Webinar for the Supernova Early Warning System (SNEWS), USA (2023/2)

7. *Search for afterglow: Light dark matter boosted by supernova neutrino*
   Seminar for the Department of Physics, National Taiwan Normal University, Taipei, Taiwan (2022/11)

8. *Searching for afterglow: Light dark matter boosted by supernova neutrinos*
   NCTS Particle Physics Journal Club, National Taiwan University, Taipei, Taiwan (2022/9)

9. *Searching light to heavy dark matter by supernova neutrinos and neutron star temperature*
   Webinar for the Sydney Consortium for Particle Physics and Cosmology (Sydney-CPPC), Sydney, Australia (2021/10)

10. *Probing dark matter with neutron star*
    Seminar for the Department of Physics, Chung Yuan Christian University, Taoyuan, Taiwan (2020/11)

11. *Probing dark matter with neutron star*
    Seminar for the Center of Astrophysics and Gravity, National Taiwan Normal University, Taipei, Taiwan (2020/7)

12. *Neutron star sensitivity on isospin-violating dark matter with self-interaction*
    Seminar for the Department of Physics, National Central University, Taoyuan, Taiwan (2020/6)

13. *Uncharted Universe*
    Colloquium for the Department of Physics, Tamkang University, New Taipei, Taiwan (2018/12)

14. *Reheating neutron stars with the annihilation of self-interacting dark matter.*
    Seminar for the Institute of Physics, National Chiao Tung University, Hsinchu, Taiwan (2018/5)

15. *Reheating neutron stars with the annihilation of self-interacting dark matter.*
    Seminar for the Institute of Physics, Academia Sinica, Taipei, Taiwan (2018/4)

16. *Indirect detection of dark matter through neutrinos*
    Seminar for the Department of Physics, Chung Yuan Christian University, Taoyuan, Taiwan (2017/12)