XUEJIAN(JACOB) SHEN

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Massachusetts Institute of Technology
77 Massachusetts Ave, Cambridge, MA 02139, USA

EDUCATION

California Institute of Technology Sept 2018 - June 2023
Ph.D., Physics
Academic and Research Advisor: Prof. Philip Hopkins
Thesis Title: Cosmic structure and galaxy formation in alternative dark matter

Peking University Sept 2014 - June 2018
B.S., Physics
Advisor: Prof. Fukun Liu
Thesis Title: Strengthened Kozai-Lidov Oscillation and Tidal Disruption Event Rate in Hierarchical SMBH Triplets

EMPLOYMENT

Postdoctoral Researcher Oct 2023 - present
Kavli Institute for Astrophysics and Space Research, Massachusetts Institute of Technology

SubMIT Project Team Oct 2023 - present
Department of Physics, Massachusetts Institute of Technology

Graduate Teaching & Research Assistant Jan 2018 - June 2023
California Institute of Technology

RESEARCH INTERESTS

Cosmological simulations of galaxy formation
The nature of dark matter; Galaxy formation and evolution at high redshift

SUMMARY OF PUBLICATIONS

Total publications: **26**; First-author publications: **9** (see attached publication list)
Metrics: **>650 citations**, **>300 first-author citations**, **h-index: 13**

AWARDS & FELLOWSHIPS

Neil Gehrels Prize/KIPAC/TCCAP Fellowship (declined) 2022
James A. Cullen Memorial Fellowship Caltech, 2022
Honored Graduate Peking University, 2018
Robin Li Fellowship Peking University, 2017
Meritorious Award MCM, 2017
HaiLiang Fellowship Peking University, 2016
GuangHua Fellowship Peking University, 2015

TEACHING & ADVISING

Caltech Graduate Teaching Assistant	Computational Physics Lab Ph20/21/22
Caltech SURF program	Co-advisor of Gabriel Aguiar (Undergraduate)
Caltech SURF program	Co-advisor of Eitan Rapaport (Undergraduate)
UROP research program	Co-advisor of Evan Erickson (Undergraduate)
MIT undergrad research program 2023	Co-advisor of Yongao Hu (Undergraduate)
MIT undergrad research program 2023	Co-advisor of Hui Wang (Undergraduate)

SYNERGISTIC ACTIVITIES

Professional Services

- Journal Referee for Monthly Notices of the Royal Astronomical Society (since 2020), The Astrophysical Journal (since 2022)
- Oscii Bascii (& Grad student representative) of Theoretical AstroPhysics Including Relativity and Cosmology (TAPIR, 2019-2022), Caltech
- Local Organizing Committee (LOC) for the Galaxy Formation and Evolution in Southern California (GalFRESCA) workshop (2022)
- SubMIT project team member (since 2023), MIT

Outreach

- Speaker at Caltech Stargazing Lecture Series (2023)
- Organizer of Stargazing and Outreach Activities (2015-2018), Peking University

SELECTED TALKS

- High-redshift predictions with Illustris-TNG	Caltech, 06/2019
- High-redshift predictions with Illustris-TNG	MIT, 08/2019
- Alternative dark matter and structure formation	Obs. Cosmo. seminar, Caltech, 11/2021
- Dwarf galaxies in dissipative dark matter	GalFRESCA workshop, 09/2022
- Alternative dark matter in galaxy formation	Harvard CfA, 10/2022
- Alternative dark matter in galaxy formation	Brown Bag lunch talk, MIT, 10/2022
- Alternative dark matter in galaxy formation	Dark Cosmos seminar, Princeton, 10/2022
- New aspects about dark matter models beyond WIMP-like CDM	KIPAC tea talk, Stanford, 02/2023
- Galaxy in the EoR in alternative dark matter	UCLA DM meeting, 03/2023
- Dark Matter: The elusive fibers of the Universe	Stargazing Lecture, Caltech, 05/2023
- The implication of UV variability for the bright galaxy abundance at cosmic dawn	KIAA/DoA seminar, PKU, 09/2023
- The implication of UV variability for the bright galaxy abundance at cosmic dawn	Journal Club, Tsinghua Univ., 09/2023
- The implication of UV variability for the bright galaxy abundance at cosmic dawn	ITC luncheon, Harvard CfA, 10/2023

PUBLICATIONS (FIRST-AUTHOR & PEER-REVIEWED)

See my NASA ADS bibliography for full information (ORCID **0000-0002-6196-823X**)

1. **Shen, Xuejian**, Mark Vogelsberger, Michael Boylan-Kolchin, Sandro Tacchella, and Rahul Kannan. The impact of UV variability on the abundance of bright galaxies at z $\geq$ 9. *MNRAS*, 525(3):3254–3261, November 2023

2. **Shen, Xuejian**, Thejs Brinckmann, David Rapetti, Mark Vogelsberger, Adam Mantz,

Jesús Zavala, and Steven W. Allen. X-ray morphology of cluster-mass haloes in self-interacting dark matter. *MNRAS*, 516(1):1302–1319, October 2022

3. **Shen, Xuejian**, Mark Vogelsberger, Dylan Nelson, Sandro Tacchella, Lars Hernquist, Volker Springel, Federico Marinacci, and Paul Torrey. High-redshift predictions from IllustrisTNG - III. Infrared luminosity functions, obscured star formation, and dust temperature of high-redshift galaxies. *MNRAS*, 510(4):5560–5578, March 2022

4. **Shen, Xuejian**, Philip F. Hopkins, Lina Necib, Fangzhou Jiang, Michael Boylan-Kolchin, and Andrew Wetzel. Dissipative dark matter on FIRE - I. Structural and kinematic properties of dwarf galaxies. *MNRAS*, 506(3):4421–4445, September 2021

5. **Shen, Xuejian**, Mark Vogelsberger, Dylan Nelson, Annalisa Pillepich, Sandro Tacchella, Federico Marinacci, Paul Torrey, Lars Hernquist, and Volker Springel. High-redshift JWST predictions from IllustrisTNG: II. Galaxy line and continuum spectral indices and dust attenuation curves. *MNRAS*, 495(4):4747–4768, July 2020

6. **Shen, Xuejian**, Philip F. Hopkins, Claude-André Faucher-Giguère, D. M. Alexander, Gordon T. Richards, Nicholas P. Ross, and R. C. Hickox. The bolometric quasar luminosity function at z = 0-7. *MNRAS*, 495(3):3252–3275, January 2020

PUBLICATIONS (FIRST-AUTHOR & UNDER REVIEW)

1. **Shen, Xuejian**, Josh Borrow, Mark Vogelsberger, Enrico Garaldi, Aaron Smith, Rahul Kannan, Sandro Tacchella, Jesús Zavala, Lars Hernquist, Jessica Y. C. Yeh, and Chunyuan Zheng. THESAN-HR: Galaxies in the Epoch of Reionization in warm dark matter, fuzzy dark matter and interacting dark matter. *arXiv e-prints*, page arXiv:2304.06742, April 2023 (submitted to MNRAS)

2. **Shen, Xuejian**, Huangyu Xiao, Philip F. Hopkins, and Kathryn M. Zurek. Disruption of Dark Matter Minihaloes in the Milky Way environment: Implications for Axion Miniclusters and Early Matter Domination. *arXiv e-prints*, page arXiv:2207.11276, April 2023 (submitted to ApJ)

3. **Shen, Xuejian**, Philip F. Hopkins, Lina Necib, Fangzhou Jiang, Michael Boylan-Kolchin, and Andrew Wetzel. Dissipative Dark Matter on FIRE: II. Observational signatures and constraints from local dwarf galaxies. *arXiv e-prints*, page arXiv:2206.05327, May 2023 (submitted to ApJ)

PUBLICATIONS (CO-AUTHORED & PEER-REVIEWED)

1. Guochao Sun, Claude-André Faucher-Giguère, Christopher C. Hayward, and **Shen, Xuejian**. Seen and unseen: bursty star formation and its implications for observations of high-redshift galaxies with JWST. *MNRAS*, 526(2):2665–2672, December 2023

2. Guochao Sun, Claude-André Faucher-Giguère, Christopher C. Hayward, **Shen, Xuejian**, Andrew Wetzel, and Rachel K. Cochrane. Bursty Star Formation Naturally Explains the Abundance of Bright Galaxies at Cosmic Dawn. *ApJ*, 955(2):L35, October 2023

3. Philip F. Hopkins, Ethan O. Nadler, Michael Y. Grudić, **Shen, Xuejian**, Isabel Sands, and Fangzhou Jiang. Novel conservative methods for adaptive force softening in collisionless and multispecies N-body simulations. *MNRAS*, 525(4):5951–5977, November 2023

4. Philip F. Hopkins, Alexander B. Gurvich, **Shen, Xuejian**, Zachary Hafen, Michael Y. Grudić, Shalini Kurinchi-Vendhan, Christopher C. Hayward, Fangzhou Jiang, Matthew E. Orr, Andrew Wetzel, Dušan Kereš, Jonathan Stern, Claude-André Faucher-Giguère, James Bullock, Coral Wheeler, Kareem El-Badry, Sarah R. Loebman, Jorge Moreno, Michael Boylan-Kolchin, and Eliot Quataert. What causes the formation of discs and end of bursty star formation? *MNRAS*, 525(2):2241–2286, October 2023

5. Sandip Roy, **Shen, Xuejian**, Mariangela Lisanti, David Curtin, Norman Murray, and Philip F. Hopkins. Simulating Atomic Dark Matter in Milky Way Analogs. *ApJ*, 954(2):L40, September 2023

6. Fangzhou Jiang, Andrew Benson, Philip F. Hopkins, Oren Slone, Mariangela Lisanti, Manoj Kaplinghat, Annika H. G. Peter, Zhichao Carton Zeng, Xiaolong Du, Shengqi Yang, and **Shen, Xuejian**. A semi-analytic study of self-interacting dark-matter haloes with baryons. *MNRAS*, 521(3):4630–4644, May 2023

7. Razieh Emami, Lars Hernquist, Mark Vogelsberger, **Shen, Xuejian**, Joshua S. Speagle, Jorge Moreno, Charles Alcock, Shy Genel, John C. Forbes, Federico Marinacci, and Paul Torrey. On the Robustness of the Velocity Anisotropy Parameter in Probing the Stellar Kinematics in Milky Way-Like Galaxies: Takeaway from TNG50 Simulation. *ApJ*, 937(1):20, September 2022

8. Rahul Kannan, Aaron Smith, Enrico Garaldi, **Shen, Xuejian**, Mark Vogelsberger, Rüdiger Pakmor, Volker Springel, and Lars Hernquist. The THESAN project: predictions for multitracer line intensity mapping in the epoch of reionization. *MNRAS*, 514(3):3857–3878, August 2022

9. Huangyu Xiao, **Shen, Xuejian**, Philip F. Hopkins, and Kathryn M. Zurek. SMBH seeds from dissipative dark matter. *J. Cosmol. Astropart. Phys.*, 2021(7):039, July 2021

10. Razieh Emami, Lars Hernquist, Charles Alcock, Shy Genel, Sownak Bose, Rainer Weinberger, Mark Vogelsberger, **Shen, Xuejian**, Joshua S. Speagle, Federico Marinacci, John C. Forbes, and Paul Torrey. Inferring the Morphology of Stellar Distribution in TNG50: Twisted and Twisted-stretched Shapes. *ApJ*, 918(1):7, September 2021

11. Philip Mocz, Anastasia Fialkov, Mark Vogelsberger, Fernando Becerra, **Shen, Xuejian**, Victor H. Robles, Mustafa A. Amin, Jesús Zavala, Michael Boylan-Kolchin, Sownak Bose, Federico Marinacci, Pierre-Henri Chavanis, Lachlan Lancaster, and Lars Hernquist. Galaxy formation with BECDM - II. Cosmic filaments and first galaxies. *MNRAS*, 494(2):2027–2044, May 2020

12. Mark Vogelsberger, Dylan Nelson, Annalisa Pillepich, **Shen, Xuejian**, Federico Marinacci, Volker Springel, Rüdiger Pakmor, Sandro Tacchella, Rainer Weinberger, Paul Torrey, and Lars Hernquist. High-redshift JWST predictions from IllustrisTNG: dust modelling and galaxy luminosity functions. *MNRAS*, 492(4):5167–5201, March 2020

13. Yunchong Wang, Mark Vogelsberger, Dandan Xu, **Shen, Xuejian**, Shude Mao, David Barnes, Hui Li, Federico Marinacci, Paul Torrey, Volker Springel, and Lars Hernquist. Early-type galaxy density profiles from IllustrisTNG - II. Evolutionary trend of the total density profile. *MNRAS*, 490(4):5722–5738, October 2019

14. Mark R. Lovell, Jesús Zavala, Mark Vogelsberger, **Shen, Xuejian**, Francis-Yan Cyr-Racine, Christoph Pfrommer, Kris Sigurdson, Michael Boylan-Kolchin, and Annalisa Pillepich.

ETHOS - an effective theory of structure formation: predictions for the high-redshift Universe - abundance of galaxies and reionization. *MNRAS*, 477(3):2886–2899, July 2018

PUBLICATIONS (CO-AUTHORED & UNDER REVIEW)

1. Enrico Garaldi, Rahul Kannan, Aaron Smith, Josh Borrow, Mark Vogelsberger, Rüdiger Pakmor, Volker Springel, Lars Hernquist, Daniela Galárraga-Espinosa, Jessica Y. C. Yeh, **Shen, Xuejian**, Clara Xu, Meredith Neyer, Benedetta Spina, Mouza Almualla, and Yu Zhao. The thesan project: public data release of radiation-hydrodynamic simulations matching reionization-era JWST observations. *arXiv e-prints*, page arXiv:2309.06475, September 2023

2. Takahiro Morishita, Massimo Stiavelli, Ranga-Ram Chary, Michele Trenti, Pietro Bergamini, Marco Chiaberge, Nicha Leethochawalit, Guido Roberts-Borsani, **Shen, Xuejian**, and Tommaso Treu. Enhanced Sub-kpc Scale Star-formation: Results From A JWST Size Analysis of 339 Galaxies At 5¡z¡14. *arXiv e-prints*, page arXiv:2308.05018, August 2023

3. Thomas K. Waters, Colton Peterson, Razieh Emami, **Shen, Xuejian**, Lars Hernquist, Randall Smith, Mark Vogelsberger, Charles Alcock, Grant Tremblay, Matthew Liska, John C. Forbes, and Jorge Moreno. Gas Morphology of Milky Way-like Galaxies in the TNG50: Signals of Twisting and Stretching. *arXiv e-prints*, page arXiv:2210.01051, October 2022

CONFERENCE PROCEEDINGS

1. Thomas Waters, Colton Peterson, Razieh Emami, **Shen, Xuejian**, Lars Hernquist, Randall Smith, Mark Vogelsberger, Charles Alcock, Grant Tremblay, Matthew Liska, John Forbes, and Jorge Moreno. Gas Morphology of Milky Way-like Galaxies in the TNG50: Signals of Twisting and Stretching. In *American Astronomical Society Meeting Abstracts*, volume 55 of *American Astronomical Society Meeting Abstracts*, page 279.02, January 2023

2. **Shen, Xuejian**, Philip Hopkins, Lina Necib, Fangzhou Jiang, Michael Boylan-Kolchin, and Andrew Wetzel. Dissipative Dark Matter on FIRE: Structural and kinematic properties of dwarf galaxies and observational constraints. In *American Astronomical Society Meeting #240*, volume 54 of *American Astronomical Society Meeting Abstracts*, page 347.06, June 2022