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;
Formation and evolution of galaxies and AGN at high redshift

SUMMARY OF PUBLICATIONS

Total publications: **28**; First-author publications: **9** (see attached publication list)
Metrics: >**750 citations**, >**350 first-author citations**, **h-index: 15**

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)
MIT UROP program	Advisor of Evan Erickson (Undergraduate)
MIT UROP program	Advisor of Yongao Hu (Undergraduate)
MIT UROP program	Advisor of Hui Wang (Undergraduate)
MIT UROP program	Co-advisor of Vinh Tran (Undergraduate)
MIT UROP program	Co-advisor of Eidan Leonard (Undergraduate)
Lectures on Numeric Simulations	MIT Physics 8.902 Astrophysics II

SYNERGISTIC ACTIVITIES

Professional Services
- Journal Referee for Monthly Notices of the Royal Astronomical Society (since 2020), The Astrophysical Journal (since 2022), The Astrophysical Journal Letter (since 2022), Scientific Reports (Since 2023)
- 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

Invited:

- Alternative DM and structure formation	Obs. Cosmo. seminar, Caltech, 11/2021
- New aspects about DM models beyond	KIPAC tea talk, Stanford, 02/2023
- Dark Matter: Elusive fibers of the Universe WIMP-like CDM	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
- Radiation-hydro simulations of galaxies at cosmic dawn	Univ. of Cambridge, 06/2024

Contributed:

- High-redshift predictions with Illustris-TNG	Caltech, 06/2019
- High-redshift predictions with Illustris-TNG	MIT, 08/2019
- Dwarf galaxies in dissipative dark matter	GalFRESCA workshop, 09/2022
- Alternative DM in galaxy formation	FIRE seminar, 10/2022

- Alternative DM in galaxy formation	Harvard CfA, 10/2022
- Alternative DM in galaxy formation	Brown Bag lunch talk, MIT, 10/2022
- Alternative DM in galaxy formation	Dark Cosmos seminar, Princeton, 10/2022
- Galaxy in the EoR in alternative DM	UCLA DM meeting, 03/2023
- The implication of UV variability for the bright galaxy abundance at cosmic dawn	ITC luncheon, Harvard CfA, 10/2023
- Challenges to galaxy formation models at high redshifts	Harvard CfA, 02/2024
- Challenges to galaxy formation models at high redshifts	Univ. of Vienna, 02/2024
- Radiation-hydro simulations of galaxies at cosmic dawn	Building Galaxies from Scratch Journal Club, MIT, 04/2024

PUBLICATIONS (FIRST-AUTHOR & PEER-REVIEWED)

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

1. Xuejian Shen, 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. *MNRAS*, 527(2):2835–2857, January 2024

2. **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

3. **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

4. **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

5. **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

6. **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

7. **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**, 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 (accepted by ApJ)

2. **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. Thomas K. Waters, Colton Peterson, Razieh Emami, Xuejian Shen, 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 Simulation: Signals of Twisting and Stretching. *ApJ*, 961(2):193, February 2024

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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

8. 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

9. 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

10. 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

11. 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

12. 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

13. 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

14. 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

15. 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. Aidan Leonard, Stephanie O'Neil, Xuejian Shen, Mark Vogelsberger, Olivia Rosenstein, Hoatian Shangguan, Yuanhong Teng, and Jiayi Hu. Varying primordial state fractions in exo- and endothermic SIDM simulations of Milky Way-mass haloes. *arXiv e-prints*, page arXiv:2401.13727, January 2024

2. Caleb Gemmell, Sandip Roy, Xuejian Shen, David Curtin, Mariangela Lisanti, Norman Murray, and Philip F. Hopkins. Dissipative Dark Substructure: The Consequences of Atomic Dark Matter on Milky Way Analog Subhalos. *arXiv e-prints*, page arXiv:2311.02148, November 2023

3. 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

4. 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

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