CIERA & Northwestern University
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Guochao (Jason) Sun

Research Interests

Theoretical/computational astrophysics: galaxy formation and evolution, epoch of reionization, first stars
Observational cosmology: large-scale structure, cosmic background radiations, intensity mapping

Positions

2022–present **CIERA Postdoctoral Fellow**, CIERA & Northwestern University

Education

2016–2022 **PhD in Astrophysics**, California Institute of Technology
Advisor: James J. (Jamie) Bock

2018 **MSc in Astrophysics**, California Institute of Technology

2011–2015 **BSc in Astrophysics**, *summa cum laude*, University of California, Los Angeles (UCLA)
Advisor: Steven R. Furlanetto

Honors and Awards

2022 China Outstanding Self-Financed Students Abroad Award, Ministry of Education of PRC
2022 Tombrello Scholar, Caltech
2021 David and Barbara Groce Travel Fund, Caltech
2015 Charles Geoffrey Hilton Award for Excellence in Astronomy, UCLA
2014 Summer Undergraduate Research Fellowship (SURF), Caltech
2011–2015 Dean's Honors List, every quarter, UCLA
2009 35th Prof. Harry Messel International Science School Scholarship, University of Sydney

Selected Presentations

Oct 2023 Astrophysics Theory Seminar, Johns Hopkins University, Baltimore, USA
Sep 2023 CPAC Group Seminar, Argonne National Lab, Lemont, USA
Aug 2023 Contributed Talk, 2023 SC Galaxy Formation Workshop, Santa Cruz, USA
Jun 2023 Poster, First Light Conference, Boston, USA
Jun 2023 Contributed Talk, Fake Light Workshop, New York, USA
Apr 2023 UZH Astro/Cosmology Seminars, University of Zurich, Zurich, Switzerland
Apr 2023 Contributed Talk, Present and Future of Line-Intensity Mapping Workshop, Garching, Germany
Apr 2023 NRL Astro Seminar, US Naval Research Lab, Washington, USA
Mar 2023 USC Cosmology Seminar, University of Southern California, Los Angeles, USA
Jun 2022 Contributed Talk, 240th American Astronomical Society Meeting, Pasadena, USA
Mar 2022 Contributed Talk, Reionization and Cosmic Dawn: Looking Forward To the Past, Berkeley, USA
Nov 2019 BCCP Seminar, UC Berkeley, Berkeley, USA
Jul 2019 Contributed Talk, L2S2: Lines in the Large Scale Structure, Marseille, France

Successful Proposals

2023 Co-I | JWST Cycle 2 AR-03252 | *New Predictions for Galaxy Metallicity Scaling Relations in the JWST Era: Departures from Equilibrium Models and Implications for the Cosmic Baryon Cycle*

2021 Co-I | ALMA Cycle 8 2021.1.01117.S | *A mysterious population of massive quiescent galaxies at* $z \sim 4$

2019/2023 Co-I | NSF AAG 1910598 | *Measuring the Reionization of the Universe and the Growth of Molecular Gas at Cosmic Dawn with TIME*

Professional Activities

2021– Referee for ApJ, MNRAS, A&A

Mentoring & Teaching Experiences

Summer 2023 Mentored Owen Gonzales (UG@Wesleyan) through NU REU program
Project: Building and characterizing a comprehensive library of high-z star formation histories

2022–2023 Mentored Lunjun Liu (Grad@Caltech)
Project: Effects of bursty star formation on [CII] line intensity mapping; 1 paper to be submitted

Summer 2021 Co-mentored Jasmine Parsons (UG@McGill) through Caltech/JPL SURF program
Project: Probing the IMF of Pop III stars with line intensity mapping; 1 paper published in ApJ

Summer 2021 Co-mentored Baria Khan (UG@UToronto) through UToronto SURP program
Project: Cross-correlating Roman photo-z galaxy surveys with CO intensity maps

2020–2021 Co-mentored Michael Gonzalez (UG@Caltech) through JPL research internship program
Project: Developing a semi-numerical tool for line intensity mapping; 2 papers published in ApJ

Services and Outreach

2023 Participant of the Fall 2023 session of Adopt-a-Physicist

Jul 2022 Astronomy on Tap (Chinese Version) Lecture on *Ways to Become an Astronomer*

Jun 2022 Chambliss Judge, 240th AAS

Feb 2022 Caltech Astronomy Stargazing Public Lecture Series on *Mapping the Universe*

2011–2013 Chief Telescope Operator, UCLA Undergraduate Astronomical Society

References

Claude-André Faucher-Giguère,
Professor of Astronomy,
Northwestern University,
cgiguere@northwestern.edu

James J. Bock,
Professor of Physics,
California Institute of Technology,
jjb@astro.caltech.edu

Steven R. Furlanetto,
Professor of Astronomy,
University of California, Los Angeles,
sfurlane@astro.ucla.edu

Tzu-Ching Chang,
Senior Research Scientist,
Jet Propulsion Laboratory,
tzu-ching.chang@jpl.nasa.gov

First-/Corresponding-Author Publications

11. **Sun G.**, Faucher-Giguère C.-A., Hayward C. C., et al., *Bursty Star Formation Naturally Explains the Abundance of Bright Galaxies at Cosmic Dawn*, 2023, ApJL, 955, L35 **(in media: Reuters, WashPost, Physics Today)**

10. **Sun G.**, Lidz A., Faisst A. L., & Faucher-Giguère C.-A., *Probing bursty star formation by cross-correlating extragalactic background light and galaxy surveys*, 2023, MNRAS, 524, 2395

9. **Sun G.**, Faucher-Giguère C.-A., Hayward C. C., & Shen X., *Seen and unseen: bursty star formation and its implications for observations of high-redshift galaxies with JWST*, 2023, MNRAS, 526, 2665

8. **Sun G.**, Mas-Ribas L, Chang T.-C., et al., *LIMFAST. II. Line Intensity Mapping as a Probe of High-redshift Galaxy Formation*, 2023, ApJ, 950, 40

7. Mas-Ribas L, **Sun G.**, Chang T.-C., et al., *LIMFAST. I. A Seminumerical Tool for Line Intensity Mapping*, 2023, ApJ, 950, 39

6. **Sun G.**, *Cosmological Constraints on the Global Star Formation Law of Galaxies: Insights from Baryon Acoustic Oscillation Intensity Mapping*, 2022, ApJL, 931, L29

5. **Sun G.**, Mirocha J., Mebane R. H., & Furlanetto S. R., *Revealing the formation histories of the first stars with the cosmic near-infrared background*, 2021, MNRAS, 508, 1954

4. **Sun G.**, Chang T.-C., Uzgil B. D., et al., *Probing Cosmic Reionization and Molecular Gas Growth with TIME*, 2021, ApJ, 915, 33

3. **Sun G.**, Hensley B. S., Chang T.-C., Doré O., & Serra P., *A Self-consistent Framework for Multiline Modeling in Line Intensity Mapping Experiments*, 2019, ApJ, 887, 142 **(JPL Research Highlight)**

2. **Sun G.**, Moncelsi L., Viero M.-P., et al., *A Foreground Masking Strategy for [CII] Intensity Mapping Experiments Using Galaxies Selected by Stellar Mass and Redshift*, 2018, ApJ, 856, 107

1. **Sun G.** & Furlanetto S. R., *Constraints on the star formation efficiency of galaxies during the epoch of reionization*, 2016, MNRAS, 460, 417

Publications with Major Contributions

2. Viero M. P., **Sun G.**, Chung D. T., et al., *The early Universe was dust-rich and extremely hot*, 2022, MNRAS, 516, L30

1. Parsons J., Mas-Ribas L, **Sun G.**, et al., *Probing Population III Initial Mass Functions with He II/Hα Intensity Mapping*, 2022, ApJ, 933, 141

Other Publications

7. Gandhi P. J., Wetzel A., Boylan-Kolchin M., et al. (incl. **Sun G.**), *Testing the near-far connection with FIRE simulations: inferring the stellar mass function of the proto-Local Group at $z > 6$ using the fossil record of present-day galaxies*, 2023, MNRAS submitted, arXiv:2309.09940

6. Qezlou M., Bird S., Lidz A., et al. (incl. **Sun G.**), *Boosting line intensity map signal-to-noise ratio with the Lyα forest cross-correlation*, 2023, MNRAS, 524, 1933

5. White N. E., Bauer F. E., Baumgartner W., et al. (incl. **Sun G.**), *The Gamow Explorer: a Gamma-Ray Burst Observatory to study the high redshift universe and enable multi-messenger astrophysics*, 2021, SPIE, 11821, 1182109

4. Lidz A., Chang T.-C., Mas-Ribas L., & **Sun G.**, *Future Constraints on the Reionization History and the Ionizing Sources from Gamma-Ray Burst Afterglows*, 2021, ApJ, 917, 58

3. Hunacek J., Bock J., Bradford C. M., et al. (incl. **Sun G.**), *Hafnium Films and Magnetic Shielding for TIME, A mm-Wavelength Spectrometer Array*, 2018, JLTP, 193, 893

2. Furlanetto S. R., Mirocha J., Mebane R. H., & **Sun G.**, *A minimalist feedback-regulated model for galaxy formation during the epoch of reionization*, 2017, MNRAS, 472, 1576

1. Mirocha J., Furlanetto S. R., & **Sun G.**, *The global 21-cm signal in the context of the high- z galaxy luminosity function*, 2017, MNRAS, 464, 1365

Publications in Preparation

3. **Sun G.**, Chang, T.-C., Lidz A., et al., *LIMFAST. III. Timing Cosmic Reionization with the 21 cm Line and the Near-infrared Background*, to be submitted to ApJ (draft available)

2. Marszewski, A., **Sun G.**, Faucher-Giguère C.-A., et al., *The High-redshift Mass-Metallicity Relation in the FIRE-2 Simulations*, to be submitted to ApJ (draft available)

1. Liu, L.-J., **Sun G.**, Chang, T.-C., et al., *Effects of Bursty Star Formation on [CII] Line Intensity Mapping of High-redshift Galaxies*, to be submitted to ApJL (draft available)

Publication Metrics

Total citations: > 600 | Total 1st-author citations: > 300 | h-index: 12