

Alexander P. Ji

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RESEARCH INTERESTS: NEAR-FIELD COSMOLOGY

The first stars and galaxies: metal-free stars, first galaxy relics, reionization

The origin of the elements, especially the rapid neutron-capture process

Milky Way halo substructure and the nature of dark matter

EDUCATION AND APPOINTMENTS

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| Hubble Fellow , Observatories of the Carnegie Institution for Science | Aug 2017 - Present |
| Ph. D. Physics , Massachusetts Institute of Technology Advised by Anna Frebel, Astrophysics division | Sep 2012 - Jun 2017 |
| M.S. Statistics , Stanford University Focus on Applied Statistics and Machine Learning | Jun 2012 |
| B. S. Physics , Stanford University Minor in Computer Science | Jun 2011 |

HONORS, AWARDS, AND GRANTS

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| Hubble Fellowship | 2017-2020 |
| Carnegie Institution P^2 Grant | Apr 2019 |
| APS DAP Cecilia Payne-Gaposchkin Thesis Award Finalist | Apr 2019 |
| Martin Deutsch Award for Excellence in Experimental Physics, MIT | Sep 2016 |
| Young Scientist at 66th Lindau Nobel Laureate Meeting, Germany | Jun 2016 |
| Best Poster Prize, Nuclei in the Cosmos XIV, Japan | Jun 2016 |
| Henry Kendall Teaching Award, MIT | Sep 2014 |
| Whiteman Fellow, MIT | Sep 2012 - Aug 2013 |
| Outstanding Learning Assistant, American Association of Physics Teachers | Jun 2012 |
| Stanford Alumni Award of Excellence | Jun 2011 |

INVITED TALKS

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| Talk JINA-CEE Frontiers Meeting | May 2020 |
| Talk “First Star Signatures in First Galaxy Relics”, First Stars VI, Concepcion, Chile | Mar 2020 |
| Talk Chemical Evolution of Galaxies: the Next 25 Years, Sesto, Italy | Jan 2020 |
| Seminar “The lanthanide fraction distribution in metal-poor stars” JINA Online Seminars | Nov 2019 |
| Colloquium “Near-field Cosmology with the Rapid Neutron-capture Process”, Caltech | Oct 2019 |
| Talk “Chemical evolution in ultra-faint dwarf galaxies”, Hubble Symposium | Oct 2019 |
| Talk “Chemical evolution in ultra-faint dwarf galaxies”, Dwarf Galaxy Cosmology, Durham | Jul 2019 |
| Talk “Signatures of the First Stars in Relics of the First Galaxies”, APS Cecilia Payne-Gaposchkin Doctoral Dissertation Award in Astrophysics Finalist | Apr 2019 |
| Talk “Lanthanide fractions in metal-poor stars”, Hubble Symposium | Mar 2019 |
| Talk “r-process nucleosynthesis in the first galaxies”, Stellar Archaeology, Tokyo | Dec 2018 |
| Talk “Connecting dwarf galaxies to the stellar halo”, Metal-Poor Galaxy, Ringberg | Jul 2018 |
| Talk “r-process nucleosynthesis in dwarf galaxies”, AAS Denver | Jun 2018 |
| Talk “r-process nucleosynthesis in ultra-faint dwarf galaxies”, Hubble Symposium | Mar 2018 |

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| Colloquium | U. Virginia (Joint Physics/Astronomy) | Feb 2018 |
| Seminar | “A rare and prolific r-process event in Reticulum II”, CCAPP/OSU | Oct 2016 |
| Highlight Talk | “Dwarf galaxy archaeology with Reticulum II”, First Stars V, Heidelberg | Aug 2016 |
| Talk | “A single prolific r-process event preserved in an ultra-faint dwarf galaxy”, American Physical Society Hot Topics Session, April Meeting | Apr 2016 |
| Colloquium | “A rare and prolific r-process event in Reticulum II”, University of Toledo | Jan 2016 |

CONTRIBUTED TALKS AND POSTERS

| | | |
|---------------------|--|--------------|
| Talk | Chemical Abundances in UFD Galaxies, Local Group Symposium, StSci | Aug 2020 |
| Session Lead | “Near/Far Age Workshop”, Napa, CA | Dec 2019 |
| Talk | “Chemical evolution in ultra-faint dwarf galaxies”, GalFRESCA, UC Irvine | Aug 2019 |
| Talk | “Lanthanide fractions in neutron star mergers”, ASU <i>r</i> -process workshop | Mar 2019 |
| Talk | “Dwarf galaxy archaeology with Reticulum II”, UC Irvine | May 2018 |
| Talk | “A full abundance pattern in Reticulum II”, JINA Frontiers | May 2018 |
| Talk | “Homogeneous Abundances in Ultra-faint Dwarf Galaxies”, JINA Forging Connections | Jun 2017 |
| Talk | “Dwarf galaxy archaeology with Reticulum II”, The Galactic Renaissance | Feb 2017 |
| Seminars | “Dwarf galaxy archaeology with Reticulum II”, 7 talks At Caltech, CfA, UCSC, Yale, Carnegie, KIPAC, Tufts | Apr-Nov 2016 |
| Poster | “Stellar Abundances in Ultra-faint Dwarf Galaxies”, GMT Science Meeting | Sep 2017 |
| Poster | “A rare and prolific r-process event in Reticulum II”, Nuclei in the Cosmos XIV | Jun 2016 |
| Poster | “Satellite Planes in Caterpillar”, Local Group Astrostatistics Conf, U Michigan | Jun 2015 |
| Poster | “Testing early star formation”, Near-Field Far-Field Conf, UC Irvine | Feb 2014 |

TEACHING

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| Professional Development Program* | ISEE (as team leader, with A. Lanz, S. Uddin) | 2019 |
| Lecturer | “Cosmology and First Stars”, JINA Frontiers Summer School, MSU | 2019 |
| Professional Development Program* | ISEE (with R. McGurk, D. French) | 2018 |
| Workshop | Carnegie, Scientific Writing Workshop for Undergraduates (with J. Teske) | 2017 |
| Teaching Assistant | MIT, 8.282/8.284: Intro to Astronomy/Modern Astrophysics | 2014/2016/2017 |
| Head Teaching Assistant | Stanford, Physics 25/26: Modern Physics | 2012 |
| Teaching Assistant | Stanford, Physics 63: Electricity, Magnetism, and Waves | 2012 |
| Teaching Assistant* | Stanford, Physics 62: Classical Mechanics Laboratory | 2010/2011 |
| Instructor* | Stanford, Physics 91SI: Practical Computing for Scientists | 2011 |
| Teaching Assistant | Stanford, Physics 24: Electricity and Optics Laboratory | 2011 |
| Resident Tutor | Stanford CTL, Math, science, and engineering tutoring | 2009 - 2010 |
| Section Leader | Stanford, CS 106A/B: Programming Methods/Abstractions | 2008 - 2009 |

* Led or assisted in curriculum development

SELECTED OUTREACH AND SERVICE

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| Referee | for ApJ, MNRAS, A&A | |
| Co-Organizer | JINA-CEE Chemical Evolution Workshop | Mar 2020 |
| Climate Survey Working Group | Carnegie Institution for Science | 2019–2020 |
| Reviewer | NASA FINESST Proposals | 2019–2020 |
| Public Talk | “Glimpses of the Cosmic Dawn”, Pasadena City College Lectures | Sep 2019 |

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| Program Committee for JINA First Frontiers Summer School | May 2019 |
| Public Talk “Glimpses of the Cosmic Dawn”, Huntington Library Astronomy Lectures | Mar 2019 |
| Public Talk “Glimpses of the Cosmic Dawn”, Carnegie Lunch with an Astronomer | Nov 2017 |
| Public Talk “Searching for the First Stars”, Carnegie Open House | Oct 2017 |
| Public Talk “Glimpses of the Cosmic Dawn”, Whitin Observatory at Wellesley | Apr 2017 |
| Public Talk “The First Stars”, MIT IAP | Jan 2017 |
| Einstein in the Classroom Instructor Cambridge Science Festival | Apr 2015 |
| Public Talks “The Universe in a Box” and “The First Stars”, MIT IAP | 2014/2015 |
| Mentor for two undergraduate students and one high school student at MIT | 2013 - 2017 |

TELESCOPE AND COMPUTING ALLOCATIONS

Magellan/MIKE High-resolution spectroscopy, >20 nights (PI)
Magellan/M2FS Multi-object spectroscopy, 3 nights (PI)
Magellan/IMACS Multi-object spectroscopy, 2 nights (PI)
VLT/FLAMES Multi-object spectroscopy, 1.6 nights (PI)
Gemini/GRACES High-resolution spectroscopy, 3.4 nights (PI)
Keck/HIRES High-resolution spectroscopy, 2 nights (Co-I)
DCT/EXPRES High-resolution spectroscopy, 2 nights (Co-I)
Du Pont/Echelle High-resolution spectroscopy, 7 nights (PI)
Hubble/ACS 29 orbits (Co-I)
XSEDE/Stampede, Comet 10 million CPU hours (Co-I)

STUDENT COLLABORATORS

Graduate Students Kaley Brauer (MIT, 2017-present, stellar halo models)
Undergraduates Fernando Barceló (Pomona, 2019, Pop III mass function); Jose Arizmendi, Allen Marquez (ELAC, 2019, metal-poor star abundances); Sergio Escobar (Caltech, 2018, stellar halo kinematics); Maude Gull, Madelyn Cain (MIT, 2016-2018, r-process star abundances); Lizhou Sha (MIT, 2016-2017, dark matter simulations)

COLLABORATION MEMBERSHIP

The Southern Stellar Stream Spectroscopic Survey (S^5 , <https://s5collab.github.io/>, Project Builder)
 The *Caterpillar* Project (<https://www.caterpillarproject.org/>, Project Builder)
 The R-Process Alliance (RPA)
 The Magellanic Satellites Survey (MagLiteS)
 DECam Local Volume Exploration Survey (DELVE, <https://delve-survey.github.io/>)
 Joint Institute for Nuclear Astrophysics - Center for the Evolution of the Elements (JINA-CEE) member

PUBLICATIONS

14 refereed first and second author papers, 497 total citations, h -index = 10.

32 refereed papers, 1093 total citations, h -index = 17. As of Mar 2020 (via NASA ADS).

FIRST AND SECOND AUTHOR PUBLICATIONS

14. **Ji, A. P.**, Li, T. S., Simon, J. D., et al., *Detailed Abundances in the Ultra-Faint Magellanic Satellites Carina II and III*, 2020, ApJ, 889, 27
13. **Ji, A. P.**, Drout, M. R., & Hansen, T. T., *The Lanthanide Fraction Distribution in Metal-poor Stars: a Test of Neutron Star Mergers as the Dominant r -process Site*, 2019, ApJ, 882, 1
12. Frebel, A., **Ji, A. P.**, Ezzeddine, R., Hansen, T. T., Chiti, A., Thompson, I. B., Merle, T. *Chemical abundance Signature of J0023+0307 – A Second-Generation Main-Sequence Star with $[Fe/H] < -6$* , 2019, ApJ, 871, 146
11. Brauer, K., **Ji, A. P.**, Frebel, A., Dooley, G. A., Gomez, F. A., O’Shea, B. W. *The Origin of r -process Enhanced Metal-Poor Halo Stars In Now-Destroyed Ultra-Faint Dwarf Galaxies*, 2019, ApJ, 871, 2
10. **Ji, A. P.**, Simon, J. D., Frebel, A., Venn, K. A., Hansen, T. T. *Chemical Abundances in the Ultra-Faint Dwarf Galaxies Grus I and Triangulum II: Neutron-Capture Elements as a Defining Feature of the Faintest Dwarfs*, 2019, ApJ, 870, 83
9. **Ji, A. P.** & Frebel, A. *From Actinides to Zinc: Using the full abundance pattern of the brightest star in Reticulum II to distinguish between different r -process sites*, 2018, ApJ, 856, 138
8. Safarzadeh, M., **Ji, A. P.**, Dooley, G., Frebel, A., Scannapieco, E., Gomez, F., O’Shea, B. W. *Selecting ultra-faint dwarf candidate progenitors in cosmological N -body simulations at high redshifts*, 2018, MNRAS, 476, 5006
7. **Ji, A. P.**, Frebel, A., Ezzeddine, R., Casey, A. R. *Chemical Diversity in the Ultra-faint Dwarf Galaxy Tucana II*, 2016, ApJL, 832, 1
6. **Ji, A. P.**, Frebel, A., Simon, J. D., Chiti, A. *Complete element abundances of nine stars in the r -process galaxy Reticulum II*, 2016, ApJ, 830, 93
5. **Ji, A. P.**, Frebel, A., Chiti, A., Simon, J. D. *R -process enrichment from a single event in an ancient dwarf galaxy*, 2016, Nature, 531, 610
4. Griffen, B. F., **Ji, A. P.**, Dooley, G. A., Gomez, F. A., Vogelsberger, M., O’Shea, B. W., Frebel, A., *The Caterpillar Project: A Large Suite of Milky Way Sized Halos*, 2016, ApJ, 818, 10
3. **Ji, A. P.**, Frebel, A., Simon, J. D., Geha, M., *High-resolution spectroscopy of extremely metal-poor stars in the least evolved galaxies: Bootes II*, 2016, ApJ, 817, 41
2. **Ji, A. P.**, Frebel, A., Bromm, V., *Preserving chemical signatures of primordial star formation in the first low-mass stars*, 2015, MNRAS, 454, 659
1. **Ji, A. P.**, Frebel, A., Bromm, V., *The chemical imprint of silicate dust on the most metal-poor stars*, 2014, ApJ, 782, 95

18. Hawkins, K., Lucey, M., Ting, Y.-S., **Ji, A. P.**, . . . , *Identical or fraternal twins? The chemical homogeneity of wide binaries from Gaia DR2*, 2020, MNRAS, 492, 1164
17. Norfolk, B. J., Casey, A., . . . , **Ji, A. P.**, *Discovery of s-process enhanced stars in the LAMOST survey*, 2019, MNRAS, 490, 2219
16. Koposov, S. E., Boubert, D., Li, T. S., . . . , **Ji, A. P.** (7th/20), . . . , *Discovery of a nearby 1700 km/s star ejected from the Milky Way by Sgr A**, 2019, accepted to MNRAS (arXiv:1907.11725)
15. Li, T. S., Koposov, S. E., Zucker, D. B., . . . , **Ji, A. P.** (7th/32), . . . , *The Southern Stellar Stream Spectroscopic Survey (S⁵): Overview, Target Selection, Data Reduction, Validation, and Early Science* , 2019, MNRAS, 490, 3508
14. Kozłowski, S., Bañados, E., . . . , **Ji, A. P.**, . . . , *Discovery of two quasars at $z = 5$ from the OGLE survey*, 2019, ApJ, 878, 115
13. Placco, V., Santucci, R. M., . . . , **Ji, A. P.**, . . . , *The R-Process Alliance: Spectroscopic Follow-up of Low-metallicity Star Candidates from the Best & Brightest Survey*, 2019, ApJ, 870, 122
12. Kemp, A., Casey, A., . . . , **Ji, A. P.**, . . . , *On the discovery of K-enhanced and possibly Mg-depleted stars throughout the Milky Way*, 2018, MNRAS, 480, 1384
11. Cain, M. G., Frebel, A., Gull, M., **Ji, A. P.**, . . . , *The R-Process Alliance: Chemical Abundances for a Trio of R-Process-Enhanced Stars*, 2018, ApJ, 864, 43
10. Gull, M., Frebel, A., Cain, M. G., Placco, V., **Ji, A. P.**, . . . , *The R-Process Alliance: discovery of the first metal-poor star with a combined r- and s-process element signature*, 2018, ApJ, 862, 174
9. Chiti, A., Frebel, A., **Ji, A. P.**, Jerjen, H., Kim, D., Norris, J. E., *Chemical Abundances of New Member Stars in the Tucana II Dwarf Galaxy*, 2018, ApJ, 857, 74
8. Li, T. S., Simon, J. D., . . . , **Ji, A. P.**, . . . , *Ships Passing in the Night: Spectroscopic Analysis of Two Ultra-Faint Satellites in the Constellation Carina*, 2018, ApJ, 851, 145
7. Hartwig, T., Yoshida, N., . . . , **Ji, A. P.**, . . . , *Descendants of the first stars: the distinct chemical signature of second generation stars*, 2018, MNRAS 478, 1795
6. Griffen, B. F., Dooley, G., **Ji, A. P.**, O’Shea, B. W., Gomez, F., Frebel, A., *Tracing the origin of the first stars and galaxies within the hierarchical assembly history of the Milky Way*, 2018, MNRAS, 474, 443
5. Drout, M. R., Piro, A. L., . . . , **Ji, A. P.**, . . . , *Light Curves of the Neutron Star Merger GW170817/SSS17a: Implications for R-Process Nucleosynthesis*, 2017, Science, 358, 1570
4. Shappee, B. J., Simon, J. D., . . . , **Ji, A. P.**, . . . , *Early Spectra of the Gravitational Wave Source GW170817: Evolution of a Neutron Star Merger*, 2017, Science, 358, 1574
3. Placco, V. M., Holmbeck, E. M., . . . , **Ji, A. P.**, . . . , *RAVE J203843.2–002333: The first highly r-process enhanced star identified in the RAVE survey*, 2017, ApJ, 844, 18
2. Frebel, A., Chiti, A., **Ji, A. P.**, Jacobson, H. R., Placco, V. M., *SD 1313–0019 — another second generation star with $[Fe/H] = -5.0$, observed with the Magellan telescope*, 2015, ApJL, 810, 27
1. Dooley, G., Griffen, B. F., Zuckin, P., **Ji, A. P.**, Vogelsberger, M., Hernquist, L., Frebel, A., *The effects of varying cosmological parameters on halo substructure*, 2014, ApJ, 786, 50

5. **Ji, A. P.** et al., *Local Dwarf Galaxy Archaeology*, White Paper submitted to the Astro 2020 Decadal Survey
4. Simon, J. D. et al. including **Ji, A. P.**, *Dynamical Masses for a Complete Census of Local Dwarf Galaxies*, White Paper submitted to the Astro 2020 Decadal Survey
3. Roederer, I. U. et al. including **Ji, A. P.**, *The First Stars and the Origin of the Elements*, White Paper submitted to the Astro 2020 Decadal Survey
2. Roederer, I. U. et al. including **Ji, A. P.**, *The astrophysical r-process and the origin of the heaviest elements*, White Paper submitted to the Astro 2020 Decadal Survey
1. The MSE Science Team including **Ji, A. P.**, *The Detailed Science Case for the Maunakea Spectroscopic Explorer, 2019 edition* (contributed to Chapter 4), arXiv:1904.04907