

Alexander P. Ji

E-mail: aji@carnegiescience.edu Twitter: [@alexanderpji](https://twitter.com/alexanderpji)

Website: www.alexji.com Github: www.github.com/alexji

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

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

Hubble Fellowship	2017-2020
Carnegie Institution P^2 Grant – \$5000	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

Talk Session on Dwarf Galaxies, First Stars VI, Concepcion, Chile	Mar 2020
Talk Chemical Evolution of Galaxies: the Next 25 Years, Sesto, Italy	Jan 2020
Session Lead “Near/Far Age Workshop”, Napa, CA	Dec 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
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 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

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

Referee	for ApJ, MNRAS, A&A	
Climate Survey Working Group	Carnegie Institution for Science	2019–2020
Reviewer	NASA FINESST Proposals	2019
Public Talk	“Glimpses of the Cosmic Dawn”, Pasadena City College Lectures	Sep 2019
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, 1 night (Co-I)
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; now graduate students at Berkeley and Harvard); Lizhou Sha (MIT, 2016-2017, dark matter simulations; now TESS Quick-Look Pipeline Engineer)

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

13 refereed first and second author papers + 1 submitted, 440 total citations, h -index = 10.

30 refereed papers + 2 submitted, 968 total citations, h -index = 16. As of Oct 2019 (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*, submitted to ApJ
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*, accepted to MNRAS
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