Jerry (Wenhao) Xuan

51 Pegasi b Fellow at UCLA

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EDUCATION

Ph.D. in Astrophysics, California Institute of Technology June 2025
Advisor: Prof. Dimitri Mawet
Thesis: Probing the Origins of Directly Imaged Planets and Brown Dwarfs: From Atmospheric Compositions to Binarity

M. Sc. Astrophysics, California Institute of Technology June 2023

M.Phil. in Astronomy, University of Cambridge Oct 2020
Advisor: Prof. Mark Wyatt
Thesis: Constraining 3D orbital architectures in systems with giant planets

B.A. in Physics, Pomona College May 2019
Graduated cum laude, GPA: 3.91/4.00
Thesis: Probing the Spin of DH Tau b as a Tracer for Giant Planet Formation

GRANT AWARDS

51 Pegasi b Fellowship to UCLA (2025), $450,000
NASA Hubble Fellowship Program Sagan Fellowship (2025, declined)
Future Investigators in NASA Earth and Space Science and Technology (2023-2025), $150,000
Total awards for JWST programs, $427,718

OBSERVING TIME

JWST Cycle 4 GO 8714 (NIRSpec, MIRI, NIRCam) **PI**, 19.8 hours, $159,288
JWST Cycle 3 GO 5342 (NIRSpec) **PI**, 13.2 hours, $150,900
JWST Cycle 2 GO 3762 (NIRSpec, MIRI) **PI**, 3.8 hours, $74,911
JWST Cycle 3 GO 4982 (NIRSpec) co-I, 19.3 hours, $42,619
JWST Cycle 4 GO 8063 (NIRSpec) co-I, 59.0 hours
2018A-2025A Keck II (KPIC, NIRC2): co-I, observed for over 40 nights
ESO P112 + DDT (VLTI/GRAVITY) **PI**, 4 hours
ESO P112 (VLT/CRIRES+) **PI**, 12 hours
2023B Gemini South (IGRINS) **PI**, 16.9 hours
ESO P115 (VLT/CRIRES+) **PI**, 25 hours

SELECTED PUBLICATIONS

Refereed Journal Articles

Summary: 43 refereed articles (9 first author, 8 second author, 1014 citations). Only 1st-4th author papers are listed below. For full list see ADS.

(** student paper supervised by J.W.X.)

Atmospheres

1. **Xuan, J.W.**, Perrin, M., Mawet, D. et al. ApJL 977, L32. *Atmospheric abundances and bulk properties of the binary brown dwarf Gliese 229 Bab from JWST/MIRI spectroscopy*
2. **Xuan, J.W.**, Hsu, C-C., Finnerty, L., et al. 2024, ApJ 970, 71. *Are These Planets or Brown Dwarfs? Broadly Solar Compositions from High-resolution Atmospheric Retrievals of ∼ 10–30 MJup Companions*
3. **Xuan, J.W.**, Wang, J., Finnerty, L., et al. 2024, ApJ 962, 10. *Validation of elemental and isotopic abundances in late-M spectral types with the benchmark HIP 55507 AB system*
4. **Xuan, J.W.**, Wang, J., Ruffio, J.-B., et al. 2022, ApJ 937, 54. *A Clear View of a Cloudy Brown Dwarf Companion from High-Resolution Spectroscopy*
5. **Xuan, J.W.**, Bryan, M.L., Knutson, H.A., Bowler, B.P., Morley, C.V., Benneke, B, 2020, AJ 159, 97. *A Rotation Rate for the Planetary-mass Companion DH Tau b*
6. Zhang, Y., **Xuan, J.W.**, Mawet, D., et al. 2024, AJ 168, 131. *Atmospheric characterization of the super-Jupiter HIP 99770 b with KPIC*
7. Finnerty, L., **Xuan, J.W.**, Xin, Y., et al. 2024, AJ 167, 43. *Atmospheric metallicity and C/O of HD 189733 b from high-resolution spectroscopy*
8. Hejazi, N., **Xuan, J.W.**, Cristofari, P., et al. 2024, ApJL, in press. *Chemical Links between a Young M-type T Tauri star and its Substellar Companion: Spectral Analysis and C/O Measurement of DH Tau A*
9. Costes, J., **Xuan, J.W.**, Vigan, A., et al. 2024, A&A 686, A294. *Fresh view of the hot brown dwarf HD 984 B through high-resolution spectroscopy*
10. Inglis, J., Wallack, N., **Xuan, J.W.** et al. 2024, AJ 167, 218. *Atmospheric Retrievals of the Young Giant Planet ROXs 42B b from Low- and High-resolution Spectroscopy*
11. Hsu C.-C., Wang J. J., **Xuan J. W.** et al. 2024, ApJ 971, 9. *Rotation and Abundances of the Benchmark Brown Dwarf HD 33632 Ab from Keck/KPIC High-resolution Spectroscopy*
12. Hsu, C.-C., Wang, J., Blake, G., **Xuan, J. W.** et al. 2024, ApJL, in press. *PDS 70b Shows Stellar-like Carbon-to-Oxygen Ratio*
13. Finnerty, L., Xin, Y., **Xuan, J. W.** et al. 2024, AJ, in press. *True mass and atmospheric composition of the non-transiting hot Jupiter HD 143105 b*

Substellar binarity

1. **Xuan, J.W.**, Mérand, A., Thompson, W. et al. Nature 634, 1070–1074. *The cool brown dwarf Gliese 229B is a close binary*

Orbital architectures and dynamics

1. **Xuan, J.W.** & Wyatt, M.C., 2020, MNRAS 497, 2096. *Evidence for a high mutual inclination*

between the cold Jupiter and transiting super Earth orbiting π Men

2. **Xuan, J.W.**, Kennedy, G.M., Wyatt, M.C., Yelverton, B., 2020, MNRAS 499, 5059. *Mutual inclinations between giant planets and their debris discs in HD 113337 and HD 38529*
3. Zhang, J., Huber, D., Weiss, L., **Xuan, J. W.** et al. 2024, AJ 168, 295. *A Testbed for Tidal Migration: The 3D Architecture of an Eccentric Hot Jupiter HD 118203 b Accompanied by a Possibly Aligned Outer Giant Planet*
4. Zhang, J., Weiss, L., Huber, D., **Xuan, J. W.** et al. 2024, AJ, in press. *Discovery of a Jupiter Analog Misaligned to the Inner Planetary System in HD 73344*

High-contrast imaging and instrumentation

1. **Xuan, J.W.**, Mawet, D., Ngo, H. et al. 2018, AJ 156, 156. *Characterizing the Performance of the NIRC2 Vortex Coronagraph at W. M. Keck Observatory*
2. **Sanghi, A., **Xuan, J.W.**, Wang, J., et al. 2024, AJ 168, 215. *Efficiently Searching for Close-in Companions around Young M Dwarfs using a Multi-year PSF Library*
3. Echeverri, D., **Xuan, J.W.**, Monnier, J., et al. 2024, ApJL 965, L15. *Vortex Fiber Nulling for Exoplanet Observations: First Direct Detection of M Dwarf Companions around HIP 21543, HIP 94666, and HIP 50319*
4. Xin Y., **Xuan, J.W.**, Mawet, D., Wang, J. et al. 2023, JATIS 9(3), 035001. *On-sky speckle nulling through a single-mode fiber with the Keck Planet Imager and Characterizer*
5. Echeverri, D., **Xuan J.W.**, Jovanovic, N. et al. 2023, JATIS 9(3), 035002. *Vortex Fiber Nulling for Exoplanet Observations: Implementation and First Light*
6. Mawet, D., Ruane, G., **Xuan, J. W.** et al. 2017, ApJ 838, 92. *Observing Exoplanets with High-dispersion Coronagraphy. II. Demonstration of an Active Single-mode Fiber Injection Unit*

Communications and Reviews

1. **Xuan, J.W.** & Oppenheimer, R. 2024, Nature Research Briefing. *Brown dwarf in neighbouring solar system is actually a spinning duo*

Submitted

1. Ruffio, J.-B., **Xuan, J.W.** (joint first author) et al. accepted to Nature Astronomy. *Jupiter-like uniform metal enrichment in a system of multiple giant exoplanets*
2. **Wang, G., **Xuan, J.W.** et al. submitted. *Atmospheric Retrievals of a Cloudy L Dwarf with the Keck Planet Imager and Characterizer*

SELECTED PRESS RELEASES & NEWS

A brown dwarf discovered 30 years ago is actually twins circling each other.	**AP News**	Oct 2024
Three decades later, first brown dwarf ever found offers a surprise.	**Reuters**	Oct 2024
The first known brown dwarf is actually twins.	**Astronomy Magazine**	Oct 2024
It's Twins! Mystery of Famed Brown Dwarf Solved.	Caltech	Oct 2024
First Brown Dwarf Discovered is Actually Twins.	AMNH	Oct 2024
Inventing Tools for Detecting Life Elsewhere.	Caltech	March 2017

SELECTED TALKS

Invited

A modern view of Gliese 229 B: binarity and atmospheric analysis with JWST/MIRI

Institute for Astronomy Astrocoffee, Honolulu, HI — Nov 2024

Atmospheric compositions and binarity of directly imaged exoplanets and brown dwarfs

UCSD/SDSU Astronomy & Astrophysics Colloquium, San Diego, CA — Oct 2024

Atmospheric compositions and binarity of directly imaged exoplanets and brown dwarfs

UCLA Tuesday Lunch Seminar, Los Angeles, CA — Oct 2024

Retrieving Atmospheric Compositions of Directly Imaged Companions with High-Resolution Spectroscopy

Cloud Zwei Con Workshop, Ringberg Castle, Bavaria, Germany — Jan 2023

Atmospheric abundances of directly imaged companions from KPIC and JWST

Other Worlds Laboratory Summer Program, Santa Cruz, CA — July 2023, 2024

A Clear View of a Cloudy Brown Dwarf Companion from High-Resolution Spectroscopy

Max Planck Institute for Astronomy exocoffee, virtual — Nov 2022

Unlocking the Science Potential of Keck Planet Imager and Characterizer (KPIC) Phase II

Keck Visiting Scholars Program Exit Talk, Waimea, HI — Oct 2022

A Clear View of a Cloudy Brown Dwarf Companion from High-Resolution Spectroscopy

Ohio State University exoplanet seminar, virtual — March 2022

Ibid.

American Museum of Natural History Astrophysics seminar, New York, NY — March 2022

Ibid.

Plenary and Contributed

The first methane brown dwarf Gliese 229 B is a close binary

Plenary talk at Cool Stars 22, San Diego, CA — June 2024

High-resolution spectroscopy of imaged planets and brown dwarfs with KPIC: abundances, spins, and RVs

Plenary talk at Exoplanets 5, Leiden, Netherlands — June 2024

Are These Planets or Brown Dwarfs? Elemental Abundances in the Atmosphere of Substellar Companions

ExSoCal 2023, Pasadena, CA — Dec 2023

Ibid.

Keck Science Meeting, Berkeley, CA — Sept 2023

Early Science Results from Phase II of the Keck Planet Imager and Characterization

Keck Science Meeting, Pasadena, CA — Sept 2022

High resolution spectroscopy of directly imaged exoplanets with KPIC

Spirit of Lyot, Leiden, Netherlands — June 2022

Atmospheric composition of a cloudy brown dwarf companion from high and low resolution spectroscopy

Keck Science Meeting, San Diego, CA — Sept 2021

STUDENTS ADVISED

Samuel Whitebook (Caltech grad)	2024-
Sage Santomenna (Caltech SURF program, Pomona undergraduate)	2025-
Jacob Schimp (UIUC undergrad, advising for grad school applications)	2024
Gavin Wang (Caltech SURF program, JHU undergraduate)	2024-
Aniket Sanghi (Caltech SURF program, UT Austin undergrad, now Caltech grad)	2021-2023
Luke Handley (Caltech Astro Peer Mentoring, grad student)	2023-2024

TEACHING EXPERIENCE

Teaching Assistant, Bayesian Statistics	Caltech, 2021
Teaching Assistant, High Energy Astrophysics	Caltech, 2021
Teaching Assistant, Techniques in Observational Astronomy	Pomona College, 2017, 2018
Teaching Assistant, Spacetime, Quanta, and Entropy	Pomona College, 2016
Teaching Assistant, Intro to Stars and Galaxies	Pomona College, 2017

SERVICE & OUTREACH

Keck/SCALES Science Team Member	2024-
Keck/KPIC Instrument Team Member	2020-
Referee for MNRAS (4 papers)	2021-
Referee for A&A (8 papers)	2021-
Referee for AAS Journals (4 papers)	2022-
Referee for Scientific Reports (1 paper)	2023-
Habitable Worlds Observatory Working Group; Spectral Processing Focus Group	2024-
Teaching and Residential Assistant for the Summer Science Program (six weeks)	2019
Astronomy Outreach at Partial Solar Eclipse	2023
Public Open Evenings at Institute of Astronomy, Cambridge	2020

AWARDS, HONORS & FELLOWSHIPS

Keck Visiting Scholars Program (funded visit from July-Oct 2022)	2022
Caltech Center for Comparative Planetary Evolution Fellow	2021
Phi Beta Kappa, Sigma Xi	May 2019
Downing Scholarship (Full scholarship for M.Phil. at Cambridge)	May 2019
The Brackett Prize in Astronomy, Pomona College	May 2019
Tileston Physics Prize, Department of Physics and Astronomy, Pomona College	Nov 2018
Tileston Sophomore Physics Prize, Pomona College	Jan 2018
Tileston First Year Physics Prize, Pomona College	Dec 2016
Summer Undergraduate Research Fellowship from Caltech	Apr 2016, 2017, 2018