

Chih-Chun “Dino” Hsu

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CURRENT POSITION **Postdoctoral Associate** September 2022–present
Center for Interdisciplinary Exploration and Research in Astrophysics,
Northwestern University, Evanston, IL
Supervisor: Jason Jinfei Wang

EDUCATION **University of California, San Diego**, La Jolla, CA, USA
Doctor of Philosophy (Ph.D.) in Physics August 2016 – September 2022
Thesis: “Kinematics, Multiplicity, Rotational Dynamics, and Population Properties of Ultracool Dwarfs Inferred from High-Resolution Near-Infrared Spectroscopy”
Advisor: Adam J. Burgasser

National Tsing Hua University, Hsinchu, Taiwan
Bachelor of Science (B.S) in Physics September 2010 – June 2014
GPA: 4.22/4.3; ranked 1st out of the graduating class

RESEARCH INTERESTS lowest-mass stars; brown dwarfs; exoplanets; medium-/high-resolution spectroscopy;
very low-mass binaries; stellar populations; stellar kinematics; stellar rotation; stellar
and exoplanet atmosphere and abundance

ACADEMIC HONORS & AWARDS **Rodger Doxsey Travel Prize** June 2022
AAS 240th Meeting, Pasadena, CA
Awarded for the top 10 (out of 116 entries) graduate students within one year of
receiving or receipt of their PhD a monetary prize to enable the oral presentation
of their dissertation research (transferred from the winter AAS 239th Meeting).

Friends of the International Center fellowship 2020
UC San Diego, La Jolla, CA
Awarded for promoting international friendship, understanding, and cooperation.

Carol and George Lattimer Award for Graduate Excellence 2019–
UC San Diego, La Jolla, CA 2020
Awarded to graduate students in the Divisions of Physical Sciences who seek inter-
disciplinary approaches to problem-solving and have a strong commitment to
education, mentorship, and service.

Physics Chair’s Challenge Award * 3 2017, 2018, 2022
UC San Diego, La Jolla, CA
Awarded for supporting educational excellence and training for physics students.

Physics Excellence Award 2016
UC San Diego, La Jolla, CA
Awarded to highly qualified students admitted to the Physics PhD program.

College of Science Elite Student Award * 3 2012–2014
National Tsing Hua University, Hsinchu, Taiwan

Awarded to the top student of class based on academic achievements.

Academic Achievement Award * 5

2011–2014

National Tsing Hua University, Hsinchu, Taiwan

Awarded to top 5 % of class.

College of Science Scholarship

2013

National Tsing Hua University, Hsinchu, Taiwan

Awarded to one student in College of Science based on academic achievements.

**RESEARCH
COLLABORA-
TION**

Member of Keck Planet Imager and Characterizer (KPIC)

Member of Backyard Worlds: Planet 9

Member of Sloan Digital Sky Survey (SDSS) IV

**PUBLICATION
SUMMARY**

48 peer-reviewed publications, 6 first-author (including 1 under review), 2 second-author, and 14 non-refereed publications; h-index=16; !10-index=23 (850+ total citations)

My full publications are available at NASA ADS ORCID: 0000-0002-5370-7494

**FIRST AUTHOR
PUBLICATIONS**

- [6] **Hsu, C.**; Wang, J. J.; Xuan, J. W.; Zhang, Yapeng; Ruffio, J.-B.; Mawet, D.; Finnerty, L.; Horstman, K.; Cronin, K.; Xin, Y.; Sappéy B.; Echeverri, D.; Jovanovic, N.; Baker, A.; Bartos, R.; Blake, G. A.; Calvin, B.; Cetre, S.; Delorme, J.-R.; Doppmanns G.; Fitzgerald, M. P.; Konopacky, Q. M.; Liberman, J.; Lopez, R. A.; Morris, E.; Pezzato, J.; Schofield, T.; Skemer, A.; Wallace, J. K.; Wang, Ji, “*Distinct Rotational Evolution of Giant Planets and Brown Dwarf Companions*”, 2025, submitted to AAS Journals.
- [5] **Hsu, C.**; Wang, J. J.; Blake, G. A.; Xuan, J. W.; Zhang, Yapeng; Ruffio, J.-B.; Horstman, K.; Cronin, K.; Sappéy B.; Xin, Y.; Finnerty, L.; Echeverri, D.; Mawet, D.; Jovanovic, N.; Do Ó, C.; Baker, A.; Bartos, R.; Calvin, B.; Cetre, S.; Delorme, J.-R.; Doppmanns G.; Fitzgerald, M. P.; Liberman, J.; Lopez, R. A.; Morris, E.; Pezzato, J.; Schofield, T.; Skemer, A.; Wallace, J. K.; Wang, Ji, “*PDS 70 b Shows Stellar-like Carbon-to-Oxygen Ratio*”, 2024c, ApJL, 977, L47.
- [4] **Hsu, C.**; Burgasser, A. J.; Theissen, C. A.; Birky, J. L.; Aganze, C.; Gerasimov, R.; Schmidt, S. J.; Blake, C. H.; Covey, K. R.; Moreno-Hilario, E.; Gelino, C. R.; Serna J.; Brownstein, J. R.; Cunha K., “*The Brown Dwarf Kinematics Project (BDKP). VI. Ultracool Dwarf Radial and Rotational Velocities from SDSS/APOGEE High-resolution Spectroscopy*”, 2024b, ApJS, 274, 40.
- [3] **Hsu, C.**; Wang, J. J.; Xuan, J. W.; Ruffio, J.-B.; Morris, E.; Echeverri, D.; Xin, Y.; Liberman, J.; Finnerty, L.; Horstman, K.; Sappéy B.; Doppmann G.; Mawet, D.; Jovanovic, N.; Fitzgerald, M. P.; Delorme, J.-R.; Wallace, J. K.; Baker, A.; Bartos, R.; Blake, G. A.; Calvin, B.; Cetre, S.; Lopez, R. A.; Pezzato, J.; Schofield, T.; Skemer, A.; Wang, Ji, “*Rotation and Abundances of the Benchmark Brown Dwarf HD 33632 Ab from Keck/KPIC High-resolution Spectroscopy*”, 2024a, ApJ, 971, 9.
- [2] **Hsu, C.**; Burgasser, A. J.; Theissen, C. A., “*Discovery of the Exceptionally Short Period Ultracool Dwarf Binary LP 413-53AB*”, 2023, ApJL, 945, L6.
- [1] **Hsu, C.**; Burgasser, A. J.; Theissen, C. A.; Gelino, C. R.; Birky, J. L.; Diamant, S. J. M.; Bardalez Gagliuffi, D. C.; Aganze, C.; Blake, C. H.; Faherty, J. K., “*The Brown Dwarf Kinematics Project (BDKP). V. Radial and Rotational Velocities*

CONTRIBUTING
AUTHOR
PUBLICATIONS

- [43] S. Zúñiga-Fernández, F. J. Pozuelos, M. Dévora-Pajares, N. Cuello, M. Greklek-McKeon, K. G. Stassun, V. Van Grootel, B. Rojas-Ayala, J. Korth, M. N. Günther, A. J. Burgasser, **C. Hsu**, B. V. Rackham, K. Barkaoui, M. Timmermans, C. Cadieux, R. Alonso, I. A. Strakhov, S. B. Howell, C. Littlefield, E. Furlan, P. J. Amado, J. M. Jenkins, J. D. Twicken, M. Sucerquia, Y. T. Davis, N. Schanche, K. A. Collins, A. Burdanov, F. Davoudi, B.-O. Demory, L. Delrez, G. Dransfield, E. Ducrot, L. J. Garcia, M. Gillon, Y. Gómez Maqueo Chew, C. Janó Muñoz, E. Jehin, C. A. Murray, P. Niraula, P. P. Pedersen, D. Queloz, R. Rebolo-López, M. G. Scott, D. Sebastian, M. J. Hooton, S. J. Thompson, A. H. M. J. Triaud, J. de Wit, M. Ghachoui, Z. Benkhaldoun, R. Doyon, D. Lafrenière, V. Casanova, A. Sota, I. Plauchu-Frayn, A. Khandelwal, F. Zong Lang, U. Schroffenegger, S. Wampfler, M. Lendl, R. P. Schwarz, F. Murgas, E. Palte, H. Parviainen, “Two warm Earth-sized exoplanets and an Earth-sized candidate in the M5V-M6V binary system TOI-2267”, Accepted to A&A, August 2025
- [42] Luke Finnerty, Julie Inglis, Michael P. Fitzgerald, Daniel Echeverri, Nemanja Jovanovic, Dimitri Mawet, Geoffrey A. Blake, Ashley Baker, Randall Bartos, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Katelyn Horstman, **Chih-Chun Hsu**, Joshua Liberman, Ronald A. López, Evan Morris, Jacklyn Pezzato-Rovner, Jean-Baptiste Ruffio, Ben Sappey, Tobias Schofield, Andrew Skemer, J. Kent Wallace, Nicole L. Wallack, Jason J. Wang, Ji Wang, Yinzi Xin, Jerry W. Xuan, “The watery atmosphere of HD 209458 b revealed by joint K- and L-band high-resolution spectroscopy”, Accepted to AJ, August 2025
- [41] Katelyn A. Horstman, Jean-Baptiste Ruffio, Jason J. Wang, **Chih-Chun Hsu**, Ashley Baker, Luke Finnerty, Jerry W. Xuan, Daniel Echeverri, Yinzi Xin, Dimitri Mawet, Geoffrey A. Blake, Randall Bartos, Charlotte Z. Bond, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Michael P. Fitzgerald, Nemanja Jovanovic, Ronald Lopez, Emily C. Martin, Evan Morris, Jacklyn Pezzato, Garreth Ruane, Ben Sappey, Tobias Schofield, Andrew Skemer, Taylor Venenciano, James Kent Wallace, Ji Wang, Peter Wizinowich, “Fringing analysis and forward modeling of Keck Planet Imager and Characterizer (KPIC) spectra”, JATIS, 11, 3, 035004, August 2025
- [40] Luke Finnerty, Yinzi Xin, Jerry W. Xuan, Julie Inglis, Michael P. Fitzgerald, Shubh Agrawal, Ashley Baker, Randall Bartos, Geoffrey A. Blake, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Daniel Echeverri, Katelyn Horstman, **Chih-Chun Hsu**, Nemanja Jovanovic, Joshua Liberman, Ronald A. López, Emily C. Martin, Dimitri Mawet, Evan Morris, Jacklyn Pezzato, Jean-Baptiste Ruffio, Ben Sappey, Tobias Schofield, Andrew Skemer, Taylor venenciano, J. Kent Wallace, Nicole L. Wallack, Jason J. Wang, Ji Wang, “Water dissociation and rotational broadening in the atmosphere of KELT-20 b from high-resolution spectroscopy”, AJ, 169, 6, 333, March 2025
- [39] K. Barkaoui, J. Korth, E. Gaidos, E. Agol, H. Parviainen, F.J. Pozuelos, E. Palte, N. Narita, S. Grimm, M. Brady, J.L. Bean, G. Morello, B.V. Rackham, A.J. Burgasser, V. Van Grootel, B. Rojas-Ayala, A. Seifahrt, E. Marfil, V.M. Passegger, M. Stalport, M. Gillon, K.A. Collins, A. Shporer, S. Giacalone, S. Yalçinkaya, E. Ducrot, M. Timmermans, A.H.M.J. Triaud, J. de Wit, A. Soubkiou, C.N. Watkins, C. Aganze, R. Alonso, P.J. Amado, R. Basant, Ö. Bastürk, Z. Benkhaldoun, A. Burdanov, Y. Calatayud-Borras, J.

- Chouqar, D.M. Conti, K.I. Collins, F. Davoudi, L. Delrez, C.D. Dressing, J. de Leon, M. D’evora-Pajares, B.O. Demory, G. Dransfield, E. Esparza-Borges, G. Fern’andez-Rodriguez, I. Fukuda, A. Fukui, P.P.M. Gallardo, L. Garcia, N.A. Garcia, M. Ghachoui, S. Gerald’ia-González, Y. Gómez Maqueo Chew, J. González-Rodríguez, M.N. Günther, Y. Hayashi, K. Horne, M.J. Hooton, **C.-C. Hsu**, K. Ikuta, K. Isogai, E. Jehin, J.M. Jenkins, K. Kawauchi, T. Kagitani, Y. Kawai, D. Kasper, J.F. Kielkopf, P. Klagyivik, G. Lacedelli, D.W. Latham, F. Libotte, R. Luque, J.H. Livingston, L. Mancini, B. Massey, M. Mori, S. Muñoz Torres, F. Murgas, P. Niraula, J. Orell-Miquel, David Rapetti, R. Rebolo-Lopez, G. Ricker, R. Papini, P.P. Pedersen, A. Peláez-Torres, J.A. Pérez-Prieto, E. Poulourtzidis, P.M. Rodriguez, D. Queloz, A.B. Savel, N. Schanche, M. Sanchez-Benavente, L. Sibbald, R. Sefako, S. Sohy, A. Sota, R.P. Schwarz, S. Seager, D. Sebastian, J. Southworth, M. Stangret, G. Stefánsson, J. Stürmer, G. Srdoc, S.J. Thompson, Y. Terada, R. Vanderspek, G. Wang, N. Watanabe, F.P. Wilkin, J. Winn, R.D. Wells, C. Ziegler, S. Zúñiga-Fernández, “Technical description and performance of the phase II version of the Keck Planet Imager and Characterizer”, *A&A*, 695, 281, February 2025
- [38] Nemanja Jovanovic, Daniel Echeverri, Jacques-Robert Delorme, Luke Finnerty, Tobias Schofield, Jason J. Wang, Yinzi Xin, Jerry Xuan, J. Kent Wallace, Dimitri Mawet, Aniket Sanghi, Ashley Baker, Randall Bartos, Charlotte Z. Bond, Benjamin Calvin, Sylvain Cetre, Greg Doppmann, Michael P. Fitzgerald, Jason Fucik, Maodong Gao, Jinhao Ge, Charlotte Guthery, Katelyn Horstman, **Chih-Chun Hsu**, Joshua Liberman, Stephanie Leifer, Scott Lilley, Ronald Lopez, Eduardo Marin, Emily C. Martin, Bertrand Mennesson, Evan Morris, Reston Nash, Jacklyn Pezzato, Michael Porter, Mitsuko Roberts, Garreth Ruane, Jean-Baptiste Ruffio, Ben Sappey, Eugene Serabyn, Boqiang Shen, Andrew Skemer, Ji Wang, Edward Wetherell, Peter Wizinowich, Maissa Salama, Vincent Chambouleyron, Rebecca Jensen-Clem, Chas Beichman, “Technical description and performance of the phase II version of the Keck Planet Imager and Characterizer”, *JATIS*, 11, 015005, January 2025
- [37] Sappey, Ben; Konopacky, Quinn; Do O, Clarissa R.; Barman, Travis; Ruffio, Jean-Baptiste; Wang, Jason; Theissen, Christopher A.; Finnerty, Luke; Xuan, Jerry; Hortsman, Katelyn; Mawet, Dimitri; Zhang, Yapeng; Inglis, Julie; Wallack, Nicole L.; Sanghi, Aniket; Baker, Ashley; Bartos, Randall; Blake, Geoffrey A.; Bond, Charlotte Z.; Calvin, Benjamin; Cetre, Sylvain; Delorme, Jacques-Robert; Doppmann, Greg; Echeverri, Daniel; Fitzgerald, Michael P.; **Hsu, Chih-Chun**; Jovanovic, Nemanja; Liberman, Joshua; Lopez, Ronald A.; Martin, Emily C.; Morris, Evan; Pezzato-Rovner, Jacklyn; Phillips, Caprice L.; Ruane, Garreth; Schofield, Tobias; Skemer, Andrew; Venenciano, Taylor; Wallace, J. Kent; Wang, Ji; Wizinowich, Peter; Xin, Yinzi, “HD 206893 B at High Spectral Resolution with the Keck Planet Imager and Characterizer (KPIC)”, *AJ*, 169, 3, 175, March 2025
- [36] Luke Finnerty, Yinzi Xin, Jerry W. Xuan, Julie Inglis, Michael P Fitzgerald, Shubh Agrawal, Ashley Baker, Geoffrey A. Blake, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppman, Daniel Echeverri, Katelyn Horstman, **Chih-Chun Hsu**, Nemanja Jovanovic, Joshua Liberman, Ronald A. López, Emily C. Martin, Dimitri Mawet, Evan Morris, Jacklyn Pezzato-Rovner, Jean-Baptiste Ruffio, Ben Sappey, Tobias Schofield, Andrew Skemer, Taylor Venenciano, J. Kent Wallace, Nicole L. Wallack, Jason J. Wang, Ji Wang, “True mass and atmospheric composition of the non-transiting hot Jupiter HD 143105 b”, *AJ*, 169, 2, 94, February 2025
- [35] Adam J. Burgasser, Adam C. Schneider, Aaron M. Meisner, Dan Caselden, **Chih-Chun Hsu**, Roman Gerasimov, Christian Aganze, Emma Softich, Preethi

- Karppoo, Christopher A. Theissen, Hunter Brooks, Thomas P. Bickle, Jonathan Gagné, Étienne Artigau, Michaël Marsset, Austin Rothermich, Jacqueline K. Faherty, J. Davy Kirkpatrick, Marc J. Kuchner, Nikolaj Stevnbak Andersen, Paul Beaulieu, Guillaume Colin, Jean Marc Gantier, Leopold Gramaize, Les Hamlet, Ken Hinckley, Martin Kabatnik Frank Kiwy, David W. Martin, Diego H. Massat, William Pendrill, Arttu Sainio, Jorg Schumann, Melina Thevenot, Jim Walla, Zbigniew Wedraski, the Backyard Worlds: Planet 9 Collaboration, “New Cold Subdwarf Discoveries from Backyard Worlds and a Metallicity Classification System for T Subdwarfs”, *ApJS*, 982, 2, 79, April 2025
- [34] Katelyn Horstman, Jean-Baptiste Ruffio, Konstantin Batygin, Dimitri Mawet, Ashley Baker, **Chih-Chun Hsu**, Jason J. Wang, Ji Wang, Sarah Blunt, Jerry W. Xuan, Yinzi Xin, Joshua Liberman, Shubh Agrawal, Quinn M. Konopacky, Geoffrey A. Blake, Clarissa R. Do O, Randall Bartos, Charlotte Z. Bond, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Daniel Echeverri, Luke Finnerty, Michael P. Fitzgerald, Nemanja Jovanovic, Ronald Lopez, Emily C. Martin, Evan Morris, Jacklyn Pezzato, Garreth Ruane, Ben Sappey, Tobias Schofield, Andrew Skemer, Taylor Venenciano, J. Kent Wallace, Nicole L. Wallack, Peter Wizinowich, “RV measurements of directly imaged brown dwarf GQ Lup B to search for exo-satellites”, *AJ*, 168, 175, October 2024
- [33] Yapeng Zhang, Jerry W. Xuan, Dimitri Mawet, Jason J. Wang, **Chih-Chun Hsu**, Jean-Baptiste Ruffio, Heather A. Knutson, Julie Inglis, Geoffrey A. Blake, Yayaati Chachan, Katelyn Horstman, Ashley Baker, Randall Bartos, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Daniel Echeverri, Luke Finnerty, Michael P. Fitzgerald, Nemanja Jovanovic, Joshua Liberman, Ronald A. López, Evan Morris, Jacklyn Pezzato, Ben Sappey, Tobias Schofield, Andrew Skemer, J. Kent Wallace, Ji Wang, Clarissa R. Do Ó, “Atmospheric characterization of the super-Jupiter HIP 99770 b with KPIC”, *AJ*, 168, 131, September 2024
- [32] Jerry W. Xuan, **Chih-Chun Hsu**, Luke Finnerty, Jason J. Wang, Jean-Baptiste Ruffio, Yapeng Zhang, Heather A. Knutson, Dimitri Mawet, Eric E. Mamajek, Julie Inglis, Nicole L. Wallack, Marta L. Bryan, Geoffrey A. Blake, Paul Mollere, Neda Hejazi, Ashley Baker, Randall Bartos, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Daniel Echeverri, Michael P. Fitzgerald, Nemanja Jovanovic, Joshua Liberman, Ronald A. Lopez, Evan Morris, Jacklyn Pezzato, Ben Sappey, Tobias Schofield, Andrew Skemer, James K. Wallace, Ji Wang, Shubh Agrawal, Katelyn Horstman, “Are these planets or brown dwarfs? Broadly solar compositions from high-resolution atmospheric retrievals of $\sim 10\text{--}30\text{ M}_{\text{Jup}}$ companions”, *ApJ*, 970, 71, July 2024
- [31] Evan C. Morris, Jason J. Wang, **Chih-Chun Hsu**, Jean-Baptiste Ruffio, Jerry W. Xuan, Jacques-Robert Delorme, Callie Hood, Marta L. Bryan, Emily C. Martin, Jacklyn Pezzato, Dimitri Mawet, Andrew Skemer, Ashley Baker, Randall Bartos, Benjamin Calvin, Sylvain Cetre, Greg Doppmann, Daniel Echeverri, Luke Finnerty, Michael P. Fitzgerald, Nemanja Jovanovic, Joshua Liberman, Ronald Lopez, Ben Sappey, Tobias Schofield, J. Kent Wallace, Ji Wang, “kappa And b is a fast rotator from KPIC High Resolution Spectroscopy”, *AJ*, 168, 144, October 2024
- [30] Federico Marocco, J. Davy Kirkpatrick, Adam C. Schneider, Aaron M. Meisner, Mark Popinchalk, Christopher R. Gelino, Jacqueline K. Faherty, Adam J. Burgasser, Dan Caselden, Jonathan Gagne, Christian Aganze, Daniella C. Bardalez-Gagliuffi, Sarah L. Casewell, **Chih-Chun Hsu**, Rocio Kiman, Peter R. M. Eisenhardt, Marc J. Kuchner, Daniel Stern, Leopold Gramaize,

- Arttu Sainio, Thomas P. Bickle, Austin Rothermich, William Pendrill, Melina Thevenot, Martin Kabatnik, Giovanni Colombo, Hiro Higashimura, Frank Kiwy, Elijah J. Marchese, Nikolaj Stevnbak Andersen, Christopher Tanner, Jim Walla, Zbigniew Wedracki, The Backyard Worlds Collaboration, “Thirteen New M Dwarf + T Dwarf Pairs Identified with WISE/NEOWISE”, *ApJ*, 967, 147, June 2024
- [29] J. C. Costes, J. W. Xuan, A. Vigan, J. Wang, V. D’Orazi, P. Mollière, A. Baker, R. Bartos, G. A. Blake, B. Calvin, S. Cetre, J. Delorme, G. Doppmann, D. Echeverri, L. Finnerty, M. P. Fitzgerald, **C. Hsu**, N. Jovanovic, R. Lopez, D. Mawet, E. Morris, J. Pezzato, C. L. Phillips, J. Ruffio, B. Sappey, A. Schneeberger, T. Schofield, A. J. Skemer, J. K. Wallace, J. Wang, “Fresh view of the hot brown dwarf HD 984 B through high-resolution spectroscopy”, *A&A*, 686, 294, June 2024
- [28] Clarissa R. Do Ó, Ben Sappey, Quinn M. Konopacky, Jean-Baptiste Ruffio, Kelly K. O’Neil, Tuan Do, Gregory Martinez, Travis S. Barman, Jayke S. Nguyen, Jerry W. Xuan, Christopher A. Theissen, Sarah Blunt, William Thompson, **Chih-Chun Hsu**, Ashley Baker, Randall Bartos, Geoffrey A. Blake, Benjamin Calvin, Sylvain Cetre, Jacques-Robert Delorme, Greg Doppmann, Daniel Echeverri, Luke Finnerty, Michael P. Fitzgerald, Julie Inglis, Nemanja Jovanovic, Ronald A. López, Dimitri Mawet, Evan Morris, Jacklyn Pezzato, Tobias Schofield, Andrew Skemer, J. Kent Wallace, Jason J. Wang, Ji Wang, Joshua Liberman, “Orbital and Atmospheric Characterization of the 1RXS J034231.8+121622 System Using High-Resolution Spectroscopy Confirms That The Companion is a Low-Mass Star”, *AJ*, 167, 278, June 2024
- [27] Daniel Echeverri, Jerry W. Xuan, John D. Monnier, Jacques-Robert Delorme, Jason J. Wang, Nemanja Jovanovic, Katelyn Horstman, Garreth Ruane, Bertrand Mennesson, Eugene Serabyn, Dimitri Mawet, J. Kent Wallace, Sofia Hillman, Ashley Baker, Randall Bartos, Benjamin Calvin, Sylvain Cetre, Greg Doppmann, Luke Finnerty, Michael P. Fitzgerald, **Chih-Chun Hsu**, Joshua Liberman, Ronald Lopez, Maxwell Millar-Blanchaer, Evan Morris, Jacklyn Pezzato, Jean-Baptiste Ruffio, Ben Sappey, Tobias Schofield, Andrew J. Skemer, Ji Wang, Yinzi Xin, Narsireddy Anugu, Sorabh Chhabra, Noura Ibrahim, Stefan Kraus, Gail H. Schaefer, Cyprien Lanthermann, “Vortex Fiber Nulling for Exoplanet Observations: First Direct Detection of M Dwarf Companions around HIP 21543, HIP 94666, and HIP 50319”, *ApJL*, 965, 15, April 2024
- [26] Austin Rothermich; Jacqueline K. Faherty; Daniella Bardalez-Gagliuffi; Adam C. Schneider; J. Davy Kirkpatrick; Aaron M. Meisner; Adam J. Burgasser; Mark Kuchner; Katelyn Allers; Jonathan Gagné; Dan Caselden; Emily Calamari; Mark Popinchalk; Roman Gerasimov; Christian Aganze; Emma Softich; **Chin-Chun Hsu**; Preethi Karpoor; Christopher A. Theissen; Jon Rees; Rosario Cecilio-Flores-Elie; Michael C. Cushing; Federico Marocco; Sarah Casewell; Les Hamlet; Michaela B. Allen; Paul Beaulieu; Guillaume Colin; Jean Marc Gantier; Leopold Gramaize; Peter Jalowiczor; Martin Kabatnik; Frank Kiwi; David W. Martin; Billy Pendrill; Ben Pumphrey; Arttu Sainio; Jorg Schumann; Nikolaj Stevnbak; Guoyou Sun; Christopher Tanner; Vinod Thakur; Melina Thevenot; Zbigniew Wedracki, “89 New Ultracool Dwarf Co-Moving Companions Identified With The Backyard Worlds: Planet 9 Citizen Science Project”, *AJ*, 167, 253, June, 2024
- [25] J. Davy Kirkpatrick, Federico Marocco, Christopher R. Gelino, Yadukrishna Raghu, Jacqueline K. Faherty, Daniella C. Bardalez Gagliuffi, Steven D. Schurr, Kevin Apps, Adam C. Schneider, Aaron M. Meisner, Marc J. Kuchner, Dan Caselden, R. L. Smart, S. L. Casewell, Roberto Raddi, Aurora Kesseli, Nikolaj

- Stevnbak Andersen, Edoardo Antonini, Paul Beaulieu, Thomas P. Bickle, Martin Bilsing, Raymond Chieng, Guillaume Colin, Sam Deen, Alexandru Dereveanco, Katharina Doll, Hugo A. Durantini Luca, Anya Frazer, Jean Marc Gantier, Léopold Gramaize, Kristin Grant, Leslie K. Hamlet, Hiro Higashimura, Michiharu Hyogo, Peter A. Jałowiczor, Alexander Jonkeren, Martin Kabatnik, Frank Kiwy, David W. Martin, Marianne N. Michaels, William Pendrill, Celso Pessanha Machado, Benjamin Pumphrey, Austin Rothermich, Rebekah Russwurm, Arttu Sainio, John Sanchez, Fyodor Theo Sapelkin-Tambling, Jörg Schümann, Karl Selg-Mann, Harshdeep Singh, Andres Stenner, Guoyou Sun, Christopher Tanner, Melina Thévenot, Maurizio Ventura, Nikita V. Voloshin, Jim Walla, Zbigniew Wedracki, Jose I. Adorno, Christian Aganze, Katelyn N. Allers, Hunter Brooks, Adam J. Burgasser, Emily Calamari, Thomas Connor, Edgardo Costa, Peter R. Eisenhardt, Jonathan Gagné, Roman Gerasimov, Eileen C. Gonzales, **Chih-Chun Hsu**, Rocio Kiman, Guodong Li, Ryan Low, Eric Mamajek, Blake M. Pantoja, Mark Popinchalk, Jon M. Rees, Daniel Stern, Genaro Suárez, Christopher Theissen, Chao-Wei Tsai, Johanna M. Vos, David Zurek, The Backyard Worlds: Planet 9 Collaboration, “The Initial Mass Function Based on the Full-sky 20-pc Census of $\sim 3,600$ Stars and Brown Dwarfs”, *ApJS*, 271, 55, April 2024
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NON- REFEREED PUBLICATIONS

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TALKS

“Giant Planets and Low-mass Companions Show Different Spins but Similar C/O Ratios from Keck/KPIC High-resolution Spectroscopy” October 12, 2025
51 Peg b 30th Birthday: Cool Giant Exoplanets & Their Systems, Observatoire de Haute-Provence, France

“Bifurcated Rotation of Giant Planets and Brown Dwarf Companions” September 19, 2025
Keck Science Meeting, UCLA, Los Angeles, CA

- “Rotational Signatures Between Imaged Gas Giant Exoplanets and Close Brown Dwarf Companions and Between Stellar/Substellar Boundary” June 12, 2025
AAS 246 Meeting, Anchorage, Alaska, AK
- “Rotation and Abundances of Low-mass Stars, Brown Dwarfs, and Giant Exoplanets from Keck/KPIC High-resolution Spectroscopy” September 12, 2024
Keck Science Meeting, Caltech, Pasadena, CA
- “Rotation and Abundances of Low-mass Stars, Brown Dwarfs, and Exoplanets from Keck/KPIC High-resolution Spectroscopy” July 10, 2024
Emerging Researchers in Exoplanet Science Symposium IX, Cornell University, Ithaca, NY
- “Rotation and Abundances of Low-mass Stars, Brown Dwarfs, and Exoplanets from Keck/KPIC High-resolution Spectroscopy” June 25, 2024
Cool Stars 22, University of California San Diego, San Diego, CA
- “Probing Formation and Evolution of Low-mass Stars, Brown Dwarfs, and Giant Exoplanets using High-resolution Spectroscopy” (**invited**) May 20, 2024
Monday Science Seminar, Department of Astronomy, University of Wisconsin-Madison, WI
- “The Brown Dwarf Kinematics Project (BDKP). VI. Ultracool Dwarf Radial and Rotational Velocities from SDSS/APOGEE High-Resolution Spectroscopy ” January 10, 2024
AAS 243 Meeting, Ernest N. Morial Convention Center, New Orleans, LA
- “Rotation of Directly-Imaged Brown Dwarfs and Gas Giant Exoplanets with KPIC” October 27, 2023
Great Lakes Exoplanets Area Meeting, Indiana University, Bloomington, IN
- “Discovery of the Shortest-Period Ultracool Dwarf Binary” January 11, 2023
AAS 241 Meeting, Seattle Convention Center, Seattle, WA
- “Discovery of the Shortest-Period Ultracool Dwarf Binary” (**press conference**) January 10, 2023
AAS 241 Meeting Press Conference, Seattle Convention Center, Seattle, WA
- “Kinematics, Rotation, and Multiplicity of Ultracool Dwarfs with High-Resolution Near-Infrared Spectroscopy” (**dissertation talk; Rodger Doxsey Prize**) June 14, 2022
AAS 240 Meeting, Pasadena Convention Center, Pasadena, CA
- “Forward-Modeling High-Resolution Spectroscopic Data of Ultracool Dwarfs with Large Public Archives” June 3, 2022
HDSI Internal Talk, Halicioglus Data Science Institute, UC San Diego, Virtual
- “Kinematics, Rotation, and Multiplicity of Ultracool Dwarfs with High-Resolution Near-Infrared Spectroscopy” (**invited**) May 25, 2022
IPAC Seminar Series, Infrared Processing and Analysis Center, Virtual
- “Radial and Rotational Velocities of T Dwarfs from Keck/NIRSPEC High-Resolution Spectroscopy” September 9, 2021
Keck Science Meeting, UC San Diego

“Precise Radial and Rotational Velocities of Ultracool Dwarfs with the APOGEE High-Resolution Spectrometer” August 11, 2021
2021 SDSS Collaboration Meeting, Virtual

“Radial Velocities and Kinematic Ages of Nearby T Dwarfs from Keck/NIRSPEC High-Resolution Spectroscopy” January 15, 2021
AAS 237 Meeting, Virtual

“Precise Radial and Rotational Velocities of Ultracool Dwarfs Using a Forward-Modeling Method with High-Resolution Spectroscopy” February 4, 2020
High-Resolution Infrared Spectroscopy for Exoplanet Characterization Hackathon, Caltech, Pasadena, CA

“Radial and Rotational Velocities of Ultracool Dwarfs From High-Resolution Spectroscopy” (invited) March 5, 2019
AMNH Astrophysics seminar, American Museum of Natural History, New York, NY

“Radial and Rotational Velocities of Ultracool Dwarfs From High-Resolution Spectroscopy” February 15, 2019
CASS Journal Club, UC San Diego, La Jolla, CA

POSTERS

“Rotation and Abundances of HD 33632 Ab with KPIC” July 2023
2023 Sagan Summer Workshop, Caltech, Pasadena, CA

“Kinematics, Rotation, and Multiplicity of Ultracool Dwarfs with High-Resolution Near-Infrared Spectroscopy” July 2022
The 21 Cambridge Workshops of Cool Stars, Stellar Systems and the Sun, Toulouse, France

“Radial Velocities and Kinematic Ages of Nearby T Dwarfs from Keck/NIRSPEC High-Resolution Spectroscopy” March 2021
The 20.5 Cambridge Workshops of Cool Stars, Stellar Systems and the Sun, Virtual

“Precise Radial and Rotational Velocities for over 440 Ultracool Dwarfs Observed with NIRSPEC” September 2020
Keck Science Meeting 2020, Virtual

“Precise Radial and Rotational Velocities for T Dwarfs Using NIRSPEC High-Resolution Spectrometer” September 2019
Keck Science Meeting 2019, UCLA, Los Angeles, CA

“Precise Radial and Rotational Velocities of Ultracool Dwarfs with APOGEE High-Resolution Spectra” June 2019
SDSS-IV/V Collaboration Meeting 2019, Ensenada, Mexico

“Radial and Rotational Velocities for 300+ Ultracool Dwarfs from NIRSPEC High-Resolution Spectroscopy” January 2019
AAS 233 Meeting, Seattle, WA

“Toward Measurements of Radial and Rotational Velocities of 300+ Ultracool Dwarfs from NIRSPEC High-Resolution Spectroscopy” September 2018
Keck Science Meeting 2018, Caltech, Pasadena, CA

**SELECTED
MEDIA
COVERAGE**

“Precise Radial Velocities to Detect Exoplanets around Ultracool Dwarfs Using the NIRSPEC High-Resolution Spectrograph”
September 2018
ExSoCal 2018, Caltech, Pasadena, CA

“Refined Measurements of Radial and Rotational Velocities of 300+ Ultracool Dwarfs from NIRSPEC High-Resolution Spectroscopy”
July 2018
Cool Stars 20, Boston University, Cambridge, MA

“Baby planet’s first direct atmosphere measurement”,
Chemical & Engineering News (American Chemical Society), December 2024

“Young Planet Contains Different Mix of Materials Than the Disc that Birthed It”,
Discover Magazine, December 2024

“This baby exoplanet is made of different stuff than its birth cloud”,
Space.com, December 2024

“Young exoplanet’s atmosphere unexpectedly differs from its birthplace”,
Northwestern News, December 2024

“Peeking at the formation of PDS 70 b”,
Nature Astronomy Research Highlights, December 2024

“Observations investigate properties of nearby brown dwarf HD 33632 Ab”,
Phys.org, May 2024

“Record breakers! Super-close dwarf stars orbit each other in less than a day ”,
Space.com, March 2023

“Ces deux naines ultrafroides présentent la plus courte période orbitale jamais enregistrée”,
Science & Vie (in French), April 2023

“Ultracool Dwarf Binary Stars Break Records ”,
W. M. Keck Observatory, February 2023

“Astronomers Spot A Tiny Binary System”,
Sky & Telescope, January 2023

“Ultracool dwarf binary stars break records”,
Earth Sky, January 2023

“This Record-Breaking Star System’s Year Is Shorter Than One Earth Day”,
CNET, January 2023

“Ultracool dwarf binary stars break records ”,
Northwestern News, January 2023

“Here’s how cool a star can be and still achieve lasting success”,
Science News, August 2021

“Citizen scientists help discover 95 brown dwarfs that are neighbors of our sun”,
CNN, August 2020

WORKSHOPS	<i>Research Communication Training Program</i> Northwestern University, Evanston, IL	March 26– May 29 2024
	<i>2023 Sagan Summer Workshop</i> Caltech, Pasadena, CA	July 24–28 2023
	<i>Future Keck IR Spectroscopy Workshop</i> Virtual	January 27 2021
	<i>High-Resolution Infrared Spectroscopy for Exoplanet Characterization Hackathon</i> Caltech, Pasadena, CA	February 4–6 2020
	<i>Telluric Line Hack Week Workshop</i> Flatiron Institute, New York, NY	February 25–28 2019
	<i>2017 Kraft Observational Astronomy Workshop</i> Lick Observatory, Mount Hamilton, CA	October 12–16 2017
	<i>SciCoder Workshop</i> Vanderbilt University, Nashville, TN	July 31–August 4 2017
GRANTS & FUNDINGS	<i>Characterizing the Lowest-mass Planet Hosts and Investigating the Potential Link 2024–2026 between Stellar Surface Gravity and Planet Occurrence</i> Co-I, NASA XRP (PI: Christopher Theissen), \$618k	2024–2026
	<i>Infrared Gold: A Student-Centered Program to Extract, Analyze, and Disseminate 20 Years of IRTF/SpeX Point-Source Spectroscopy</i> Co-I, NASA ADAP (PI: Adam Burgasser), \$666,511	2022–2025
TELESCOPE TIME AWARDED	James Webb Space Telescope	
	Co-I: Cycle 3: <i>Arcana of the Ancients: A Spectral Metallicity Survey of the Lowest-Mass Stars and Brown Dwarfs</i> , (PI: Adam Burgasser), 58.2 Primary Spacecraft Hours awarded	
	Co-I: Cycle 3: <i>Is CWISE 1055+5443 the first young Y-type brown dwarf?</i> , (PI: Aaron Meisner), 4.09 Primary Spacecraft Hours awarded	
	Hubble Space Telescope	
	Co-I: Cycle 32: <i>It Takes Two Planets to Tango: Constraining the Orbit of a Planetary-Mass Binary</i> , (PI: Christopher Theissen), 10 Primary Spacecraft Orbits in Cycles 32 and 33 awarded	
	Co-I: Cycle 32: <i>The Size and Shape of the Milky Way from HST pure-parallel low-mass starcounts</i> , (PI: Benne Holwerda), Archival Research	
	W. M. Keck Telescopes, Keck II 10-meter	
	PI: 2025B: <i>Toward characterizing directly imaged exoplanets in H band with KPIC high-resolution spectroscopy</i> , 0.5 nights awarded (KPIC)	
	PI: 2024B–2025A: <i>Precise Abundances of Ultracool Dwarfs using FGK Wide Binaries</i> , 4.1 nights awarded; 1.1 night awarded through Northwestern and 3.0 additional nights awarded as Co-I through Theissen’s UC access (NIRSPEC)	

PI: 2023B–2024A: *Precise Characterization of M Dwarf Exoplanet Host Abundances for KPIC*, 1.0 night awarded (NIRSPEC)

Co-I: **2022B–2024B:** *Abundances and Kinematics of Ultracool Dwarf Planet Host Twin Stars*, 4.5 nights awarded (NIRSPEC)

Co-I: **2024A:** *Keck/NIRSPEC Cadence Program: NIRSPEC Observations of Ultra-short Period Ultracool Binaries*, 0.8 nights awarded (NIRSPEC; Hsu science lead)

Co-I: **2021B–2022B:** *Galactic Archaeology with Ultracool Dwarfs: Kinematic Structure Among L Dwarfs*, 5.25 nights awarded (NIRSPEC; Hsu thesis project)

Co-I: **2021B–2022B:** *The Old and the Quick: A Search for Halo Brown Dwarfs with Backyard Worlds*, 5.5 nights awarded (NIRSPEC)

Co-I: **2019B–2020B:** *Completing the Kinematic Census of Local T Dwarfs*, 5.75 nights awarded (NIRSPEC; Hsu thesis project)

Co-I: **2018B–2021A:** *NIRSPEC Follow-up of Young T Dwarfs from Backyard Worlds*, 9 nights awarded (NIRSPEC)

Gemini South Telescope

Co-I: **2024A:** *High-resolution Near-infrared Observations of a Planetary-mass Binary*, 8 hours (IGRINS)

Co-I: **2023B:** *Is the First T Dwarf Companion a Brown Dwarf Binary?*, 16.9 hours (IGRINS)

Co-I: **2023A:** *Abundances and Kinematics of Ultracool Dwarf Planet Host Twin Stars*, 10.7 hours (IGRINS)

Co-I: **2022B:** *Discovery of an Exceptionally Short-Period Very Low Mass Binary*, 6.4 hours (IGRINS)

MMT Observatory

PI: 2023B–2025B: *Abundance Calibration of Ultracool Dwarfs Using FGK Wide-Binaries with MMT Hectochelle*, 5.0 nights awarded (Hectochelle)

Lick Observatory

PI: 2022B: *Calibrations of Chemical Abundances of Ultracool Dwarfs in Wide Binary Systems with Optical High-Resolution Spectroscopy of G-Type Primaries*, 1 night awarded (APF)

Co-I **2023B–2024B:** *Optical Spectroscopy of New and Benchmark M & L Dwarfs from Gaia and Backyard Worlds, and Potential Exoplanet Hosts from TESS and SPECULOOS*, 15 night awarded (Shane/Kast)

Co-I **2021A:** *Optical Spectroscopy of New Nearby M & L Dwarfs from Gaia & Lick-MoVeRS*, 4 night awarded (Shane/Kast)

Co-I: **2021A:** *Radial Velocity Monitoring of WISE J1624-3212: A Potential Low-mass Binary Hiding at 18 pc*, 1 night awarded (APF)

NASA InfraRed Telescope Facility (IRTF)

PI: 2024B–2025A: *Characterization of Benchmark Ultracool M Dwarfs with FGK Wide Binaries*, 27.5 hours awarded (SpeX)

PI: 2022B, 2023B: *Discovery of an Exceptionally Short-Period Very Low Mass Binary*, 6 nights awarded (iSHELL)

Co-I: 2018A–2019B: *Training the Cannon: Calibrating APOGEE Observations of Ultracool Dwarfs*, 6 nights awarded (iSHELL)

Canada France Hawaii Telescope (CFHT)

Co-I: 2021A: *Precision NIR RVs for WISE J1624-3212*, 2.4 hours awarded (SPIRou)

ADDITIONAL OBSERVING EXPERIENCE **Keck II 10-meter/NIRSPEC 7 nights** 2017–2018
 Keck I 10-meter/HIRES 0.5 nights 2018

Shane Telescope 3-meter

- Kast Double Spectrograph: 22 nights 2018–2021
- ShaneAO/ShARCS: 1 night 2019

NASA InfraRed Telescope Facility (IRTF)/SpeX 2 nights 2021–2022

MENTORSHIP Aarushi Mehrotra, high school student at Walter Payton College Prep. 2025–present
 Nathan Scott, undergraduate student at Northwestern University 2025–present
 Julianne Cronin, graduate student at Northwestern University 2023–present
 Allie Salyga, undergraduate student at Northwestern University 2023–2024
 Brigitte Vazquez, undergraduate student at UC San Diego
 → PhD student at University of Michigan 2021–2022
 Delilah Jacobsen, undergraduate student at UC San Diego 2021–2022
 Tianxing “Sky” Zhou, undergraduate student at UC San Diego
 → incoming PhD student at Brigham Young University 2021–2022

TEACHING Summary: 4 guest lectures at Northwestern University; 1-time teaching assistant at AAS Meeting workshop; 15 quarters as a teaching assistant for 6 different classes at UC San Diego; 1-time teaching assistant for Physics GRE Bootcamp at UC San Diego

Guest lecture for ASTRON 314/414 January 30, 2025
 Northwestern University, Evanston, IL
 • Introductory lecture on brown dwarf astrophysics for undergraduate and graduate physics/astronomy students

Teaching assistant for Workshop “How to Read Papers Efficiently and Effectively: A Workshop on Critical Reading for Students and Instructors” January 7, 2024
 AAS 243 Meeting, Ernest N. Morial Convention Center, New Orleans, LA
 • Introductory lecture on brown dwarf astrophysics for undergraduate and graduate physics/astronomy students

Guest lecture for ASTRON 314/414 May 11, 2023
 Northwestern University, Evanston, IL
 • Introductory lecture on brown dwarf astrophysics for undergraduate and graduate physics/astronomy students

Guest lectures for ASTRON 441 October 25 and 27, 2022
Northwestern University, Evanston, IL

- workshops on Overleaf and reading academic papers for first- and second-year astronomy Ph.D. students

Teaching assistant for PHYS 2D Spring 2021
UC San Diego, La Jolla, CA

- lower-division modern physics lecture for engineering/physical science majors

Teaching assistant for PHYS 5 Fall 2020
UC San Diego, La Jolla, CA

- lower-division introductory stellar astrophysics lecture for non-physics major

Teaching assistant for PHYS 2DL Spring & Fall 2017, 2019, Spring 2020, Fall 2021
UC San Diego, La Jolla, CA

- lower-division modern physics lab for engineering/physical science majors

Teaching assistant for PHYS 1A Spring 2018
UC San Diego, La Jolla, CA

- lower-division mechanics lab for life-science majors

Teaching assistant for PHYS 160 Winter 2018, Fall 2018
UC San Diego, La Jolla, CA

- upper-division introductory stellar astrophysics lecture for physics major

Teaching assistant for PHYS 2BL Fall 2016, Winter 2017
UC San Diego, La Jolla, CA

- lower-division electricity & magnetism lab for engineering/physics major

California Professoriate for Access to Physics Careers (CPAPC)
Southern California Physics GRE Bootcamp August 2017
UC San Diego, La Jolla, CA

PUBLIC OUTREACH

CIERA REACH Invited Panelist July 25th, 2024 & July 2nd and 23rd, 2025
Northwestern University, Evanston, IL

- “Ask Me Anything” program for high school students

Astronomy on Tap Chicago (invited) February 9th, 2023
Begyle Brewing, Chicago, IL

- Famous astronomy outreach program to general public
- “Discovery of the Closest-Separated, Fastest-Orbiting Ultracool Dwarf Couple”

Python Workshop for Physics Undergraduate Students
UC San Diego, La Jolla, CA November 2019–2021

- Python programming bridge program for transferred students to UC San Diego

**2019 Institute for Scientist & Engineer Educators (ISEE)
Professional Development Program (PDP)** March–September 2019
UC Santa Cruz/UC Los Angeles, CA

- Professional development team focused on effective and inclusive teaching, including mentoring, and also includes training in professional skills such as communication, teamwork, collaboration, and leadership.

	Institute of the Americas (IOA) Science Innovation Camp	July 20 2017
	UC San Diego, La Jolla, CA	
	• Physics outreach for Latin American high school students (14–18 year old)	
	The Barrio Logan Science & Art Expo	March 16 2019
	Mercado del Barrio, San Diego, CA	
	• Physics outreach for Mexican families from around southern San Diego	
REFEREE	AJ (2), ApJL (1), MNRAS (1)	2023–present
	Gemini observing proposal (2023A)	2022
SERVICE	Co-organizer of the CIERA Observers Group Meetings	2023 Fall–present
	AAS Meeting Session Chair	2025
PROFESSIONAL AFFILIATIONS	American Astronomical Society (AAS)	2018–Present
SKILLS	Python, L ^A T _E X, Github, HTML; Languages: Mandarin (native), English (fluent)	
REFERENCES	<p>Prof. Adam Burgasser Professor of Astronomy & Astrophysics University of California San Diego 9500 Gilman Drive 0424, La Jolla, California 92093-0424, USA aburgasser at ucsd.edu</p> <p>Prof. Christopher Theissen Assistant Professor of Astronomy & Astrophysics University of California San Diego 9500 Gilman Drive 0424, La Jolla, California 92093-0424, USA ctheissen at ucsd.edu</p> <p>Prof. Jason Wang Assistant Professor of Physics and Astronomy Northwestern University 2145 Sheridan Road, Evanston, IL 60208-3112, USA jason.wang at northwestern.edu</p>	

[CV compiled on 2025/09/03]