Zachary Hartman

Resume

PERSONAL DETAILS

Address	670 N. A'ohoku Place, Hilo, Hawaii, 96720
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EDUCATION

PhD. in Astronomy 08/2015-05/2021

Georgia State University

B.S. in Physics and Astronomy 08/2010-05/2015

Ohio State University

SKILLS

Languages	English (Native)
Software	LaTeX, Python, C++,Mathematica,IDL,Microsoft Office

RESEARCH AND OBSERVATORY WORK EXPERIENCE

Gemini Science Fellow, *Gemini North Observatory/NSF's NOIRLab* 07/2021-present

Observatory Support: I am a member of the user engagement team at Gemini Observatory. As part of this, I have organized a series of webinars for the astronomical community about Gemini South's new facility instrument GHOST, I have gone to conferences and represented Gemini, and I have helped run workshops on how to apply for Gemini time. I am also part of the NIRI, 'Alopeke, Zorro, GNIRS, and IGRINS-2 instrument teams at Gemini North Observatory. As a part of the 'Alopeke instrument team at Gemini North, I have been updating the 'Alopeke webpages with more information and have been working to streamline their use by the community. I am responsible for a number of queue programs that have been approved by the telescope allocation committees for each of the partners in Gemini Observatory or are part of Gemini's Fast-Turnaround program and ensure that they have been set up correctly within Gemini's system.

Galactic Halo Star Multiplicity Project: Besides continuing the wide binary project that is described below, I have also started a speckle imaging campaign using 'Alopeke and Zorro on Gemini North and South respectively to search for unresolved companions to Galactic halo stars within 100 pc. The multiplicity rate for nearby halo stars is largely unknown with it estimated to be between 12-40% based on three previous studies over the past decade. To this end, I have joined a collaboration that is using adaptive optics at Lick Observatory and now speckle imaging at Gemini to search for unresolved companions. The first couple of papers detailing the sample and early results are expected in the coming year.

Predoctoral Fellow, *Lowell Observatory*, Advisor: Dr. Gerard van Belle 08/2018-06/2021

QWSSI Speckle Instrument Development: I assisted in the development of the QWSSI speckle instrument at Lowell Observatory. This camera provides simultaneous observations in four visible wavelengths and two infra-red wavelengths. Besides helping with the construction and testing of the instrument itself, I have been helping to develop the reduction code for the data. This code is being written in Python and uses the current speckle reduction code that is used at Lowell Discovery Telescope as a base. This work is ongoing.

Wide Binary Speckle Follow-up: It is currently unknown whether the higher-order multiplicity rates of low-mass and solar-type wide binaries are similar. This could have implications for determining how the

widest systems formed. To this end, I have been conducting a speckle imaging survey of the widest low-mass binaries within 100 pc to determine if they are higher-order multiples or not. Preliminary results show that the higher-order multiplicity rates between the two groups may be different. This work is ongoing.

Graduate Researcher, *Georgia State University*, Advisor: Dr. Sébastien Lépine 08/2015-06/2021

Statistical analysis of stellar catalogs looking for wide binaries: Taking the high proper motion stars in Gaia DR2, I have written a code which conducts a Bayesian Analysis to determine the probability that pairs of stars are binaries. 99,203 wide binary candidates with probabilities of being gravitationally bound systems $> 95\%$ have been identified with this method. Follow-up observations are being conducted on pairs with separations larger than 10,000 AU to search for clues on their origin. These observations include speckle observations taken at various observatories and looking for eclipsing binaries in TESS, K2 and Kepler observations.

Research Assistant, *Ohio State University*, Advisor: Dr. Donald Terndrup 08/2012-05/2015

Searching for the low mass companions in sdB+dM: Conducted an analysis on light curves and spectroscopic observations of sdB+dM binary systems. Observed several such systems using KOSMOS on the 4m Mayall telescope at Kitt Peak. Additional photometry and spectroscopy was taken at MDM over a one month span.

Undergraduate Researcher, *Ohio State University*, Advisor: Dr. Carsten Rott Summer 2012

The Precision IceCube Next Generation Upgrade (PINGU): Ran simulations detailing the effectiveness of PINGU on the IceCube neutrino detection array and outputted the results using ROOT. It was found that PINGU will increase the sensitivity of the IceCube detector by an order of magnitude.

PUBLICATIONS

- *Vetting the "Lobster" Diagram: Searching for Unseen Companions in Wide Binaries Using NASA Space Exoplanet Missions*, **Hartman, Z.**, Lépine, S., Medan, I., 2022, ApJ, 934, 72
- *The SUPERWIDE Catalog: A Catalog of 99,203 Wide Binaries Found in Gaia and Supplemented by the SUPERBLINK High Proper Motion Catalog*, **Hartman, Z.**, Lépine, S., 2020, ApJS, 247, 29
- *Bayesian Cross-matching of high Proper-Motion Stars in Gaia DR2 and Photometric Metallicities of 1.7 million K and M Dwarfs*, Medan, I., Lépine, S.,**Hartman, Z.**, 2020, ApJ, 161, 234
- *HST/FGS Trigonometric Parallaxes to M-dwarf Eclipsing Binaries*, van Belle, G., Schaefer, G., von Braun, K., Nelan, E., **Hartman, Z.**, Boyajian, T., Lopez-Morales, M., Ciardi, D., 2020, PASP, 132, 21
- *Direct Measurements of Giant Star Effective Temperatures and Linear Radii: Calibration against Spectral Types and V-K Color*, van Belle, G., von Braun, K., Ciardi, D., Pilyavsky, G., Buckingham, R., Boden, A., Clark, C., **Hartman, Z.**, van Belle, G., Bucknew, W., Cole, G., 2021, AJ, 992, 163
- *Speckle Observations of TESS Exoplanet Host Stars. II. Stellar Companions at 1-1000 au and Implications for Small Planet Detection*, Lester, K., Matson, R., Howell, S., Furlan, E., Gnilka, C., Scott, N., Ciardi, D., Everett, M., **Hartman, Z.**, Hirsch, L., 2021, AJ, 162, 75
- *TFAW survey II: six newly validated planets and 13 planet candidates from K2*, del Ser, D., Fors, O., del Alcázar, M., Dyachenko, V., Horch, E. P., Tokovinin, A., Ziegler, C., van Belle, G. T., Clark, C. A., **Hartman, Z. D.**, 2023, MNRAS, 518, 669

PRESENTATIONS

- *Finding the Lights in the Shadows: A Multiple Telescope Search for Unresolved Companions to Nearby Low-Mass Wide Binary Systems and Galactic Halo Stars*, **Hartman, Z.**, van Belle, G., Lépine, S., Rich M., Kim B., Jao W., Medan I.,Sloneker, M., Clark C., 2023, Gemini South Talk
- *Initial Results from the Quad-Camera Wavefront-sensing Six-channel Speckle Interferometer: Search for Unresolved Companions in the Widest Low-mass Binaries*, **Hartman, Z.**, van Belle, G., Lépine, S., Clark, C., Everett, M., 2023, AAS 2023

- *Examining the Multiplicity of Halo Stars within 100 Parsecs with Gemini*, **Hartman, Z.**, Lépine, S., Kim, B., 2022, Gemini Science Meeting
- *K dwarf triples and quadruples in the SUPERWIDE catalog of 90,000 nearby wide binaries* by **Hartman, Z.**, Lépine, S., 2020, CoSka
- *The Tale of the Lobster: Over-luminous Stars in Wide Binaries and a Search for Higher Order Multiples*, **Hartman, Z.**, Lépine, S., Clark, C., Medan, I., van Belle, G., AAS 2020
- *The SUPERWIDE Catalog of Wide Binaries and an Initial Look at the Higher Order Multiplicity of K and M dwarf Wide Binaries*, **Hartman, Z.**, van Belle, G., Lépine, S., Clark, C., AAS 2019
- *The SUPERWIDE Catalog of Wide Binaries*, **Hartman, Z.**, Lépine, S., 2018 Cool Stars Conference proceedings
- *On the Occurrence of Wide Binaries in the Local Disk and Halo Populations*, **Hartman, Z.**, Lépine, S., AAS 2018
- *An All-Sky Search for Wide Binaries in the SUPERBLINK Proper Motion Catalog*, **Hartman, Z.**, Lépine, S., AAS 2017
- *Optical and Infrared Photometry of Low-Mass Stars in Eclipsing Binaries*, **Hartman, Z.**, Terndrup, D., AAS 2015

OBSERVING EXPERIENCE

- 4 nights using ShARCS on Lick Observatory
- 8 officially scheduled queue observing nights on Gemini South
- 41 officially scheduled queue observing nights on Gemini North
- 20 nights using QWSSI on Lowell Discovery Telescope (LDT)
- 13 nights using DSSI on LDT
- 6 nights using DSSI on Gemini South
- 13 nights using Zorro on Gemini South
- 6 nights using 'Alopeke on Gemini North
- 3 nights using HYDRA spectrograph on WIYN 3.5 m
- 1/2 night using Deveny spectrograph on LDT
- 1/2 night using IGRINS spectrograph on LDT
- $\sim$ 1 month on MDM 1.3m
- 3 nights on MDM 2.4m
- 3 nights on Mayall 4m

CONFERENCES ATTENDED

- American Astronomical Society Conference participant (2015, 2017, 2018, 2019, 2020, 2021,2023, Summer 2023)
- Gemini Science Meeting 2022
- Protostars and Planets VII
- 2019 Universe of Binaries Conference
- 2018 Cool Stars 20 Conference

OTHER HONORS AND PANELS

- NSF Panel Member 2023
- Chair of NOIRLab TAC sub-panel 2023-
- Member of NOIRLab TAC 2022
- 2018 AAS Chambliss Award
- Ohio State University Undergraduate Research Scholarship
- Ohio State University Department of Astronomy SURP participant
- Ohio State University Valentino Physics Scholar
- Ohio State University Maximus Scholarship

REFERENCES

Dr. Sébastien Lépine - slepine@gsu.edu
Dr. Atsuko Nitta - atsuko.nitta@noirlab.edu
Dr. David Jones - david.jones@noirlab.edu
Dr. Gerard van Belle - gerard@lowell.edu
Dr. John Blakeslee - john.blakeslee@noirlab.edu