

# ISABEL J. KAIN

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## EDUCATION

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<b>PhD in Astronomy and Astrophysics</b> University of California, Santa Cruz	2021 - 2027 (expected)
<b>Bachelor of Science in Physics</b> Northeastern University Minors in Mathematics, Geology	2017 - 2021

## FELLOWSHIPS AND AWARDS

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<b>NSF Graduate Research Fellowship</b>	Awarded 2021
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## EXPERIENCE

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<b>University of California, Santa Cruz</b> <i>Advisor: Prof. Andrew Skemer</i>	2021 - Present
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Contribute to development of the Santa Cruz Array of Lenslets for Exoplanet Spectroscopy (SCALES) instrument, a high-contrast imaging instrument for the W. M. Keck Observatory. Building and using testbeds for characterization of instrument optics, including mechanical modifications to high-vacuum liquid nitrogen dewars. Using optical measurements to iterate with instrument team and optics vendors.

<b>AstroTech</b>	July 2021
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Summer school for early-career astronomical instrumentalists, providing in-lab experience designing and building a spectrograph. Optomechanics specialist on instrument development team.

<b>University of Notre Dame Department of Physics</b> <i>Advisor: Prof. Jeffrey Chilcote</i>	September - December 2020
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Characterized performance of the detector of the Gemini Planet Imager (GPI), an adaptive optics instrument on the Gemini Telescope for direct imaging of exoplanets. Analyzed 7 years of dark exposures and archival telemetry to track the degradation of pixels on the H2RG detector, develop bad pixel masks for calibration, and develop corrections for affected data.

<b>Jet Propulsion Laboratory (JPL)</b> <i>Advisors: Dr. Vanessa Bailey, Dr. Akshata Krishnamurthy</i>	May - August 2020
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Characterized photometric performance for the ASTERIA CubeSat, a technology demonstration mission for high-precision pointing and thermal control, and which also carried out opportunistic exoplanet observations. Collaborated on development of Python pipeline to perform aperture photometry on ASTERIA data, and performed Python analyses of the influence of ASTERIA's spacecraft and operational environment on its data products.

<b>European Organization for Nuclear Research (CERN)</b> <i>Advisor: Prof. Toyoko Orimoto</i>	August - December 2019
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Developed test framework for new electronics and calorimeters for the Compact Muon Solenoid (CMS) Electromagnetic Calorimeter (ECAL). This included: developing firmware and for a CAEN DT5495 trigger board to control test data acquisition, and front-end development for a new VICE++ FPGA for testing prototype electronics.

Developed mission architecture for space missions, including Remote Occulter, Orbiting Configurable Artificial Star (ORCAS) missions. Used Python to analyze and visualize data, and calculate expected spacecraft performance and constraints.

Investigated planetary system K2-25 with aim of explaining unusually high eccentricity of transiting planet K2-25b, using TTV analysis to probe existence of non-transiting companion that could be pumping eccentricity. Built Python pipeline to analyze transit photometry of eccentric planet K2-25b using MCMC fitting of orbital parameters. Prepared visualizations and text for publication of results in The Astronomical Journal.

## PAPERS AND PUBLICATIONS

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Isabel Kain. *Characterization of diamond-turned optics for SCALES*. *SPIE* (in prep, 2023).

Renate Kupke, Deno R. Stelter, Amirul Hasan, Arun Surya, **Isabel Kain**, Zackery Briesemeister, Jialin Li, Phil Hinz, Andrew Skemer, Benjamin Gerard, Daren Dillon, Christopher Ratliff. *SCALES on Keck: optical design*. *SPIE* (2022).

Dillon Peng, Maeve Curliss, Mary Anne Limbach, [...], **Isabel Kain**, [...], Clarissa Do , Saavidra Perera, Eckhart Spalding. *GPI 2.0: performance of upgrades to the Gemini Planet Imager CAL and IFS*. *SPIE* (2022).

Andrew J. Skemer, R. Deno Stelter, Stephanie Sallum, [...], Isabel Kain, [...], Patrick Sheehan, Ji Man Sohn, Jordan Stone. *Design of SCALES: a 2-5 micron coronagraphic integral field spectrograph for Keck Observatory*. *SPIE* (2022).

**Isabel J. Kain**, Elisabeth R. Newton, Jason A. Dittmann, Jonathan M. Irwin, Andrew W. Mann, Pa Chia Thao, David Charbonneau, Jennifer G. Winter. *The Young Planetary System K2-25: Constraints on Companions and Starspots*. *AJ* (2020).

Jeffrey Chilcote, Quinn Konopacky, Robert J. De Rosa, [...], **Isabel Kain**, [...], Laurent Pueyo, Kaitlyn Summery, Coleman Thomas. *GPI 2.0: upgrading the Gemini Planet Imager*. *SPIE* (2020).

Pa Chia Thao, Andrew W. Mann, Marshall C. Johnson, Elisabeth R. Newton, Xueying Guo, **Isabel J. Kain**, Aaron C. Rizzuto, Paul A. Dalba, Eric Gaidos, Jonathan M. Irwin, Adam L. Kraus. *Zodiacal Exoplanets in Time (ZEIT). IX. A Flat Transmission Spectrum and a Highly Eccentric Orbit for the Young Neptune K2-25b as Revealed by Spitzer*. *AJ* (2020).

John C. Mather, Eliad Peretz, Jonathan Arenberg, [...], **Isabel Kain**, [...], Richard Slonaker, Ignas Snellen, Phil Willems. *Orbiting Starshade: Observing Exoplanets at visible wavelengths with GMT, TMT, and ELT*. *BAAS* (2019).

Eliad Peretz, John Mather, **Isabel Kain**, Richard Slonaker, John OMeara, Sara Seager, Tiffany Hoerbelt. *Orbiting Configurable Artificial Star (ORCAS) for Visible Adaptive Optics from the Ground*. *BAAS* (2019).

Ian J. M. Crossfield, Natalia Guerrero, [...], **Isabel Kain**, Howard Isaacson, David R. Ciardi, Erica J. Gonzales, Andrew W. Howard, and Jos Vincius de Miranda Cardoso. *A TESS Dress Rehearsal: Planetary Candidates and Variables from K2 Campaign 17*. *ApJS* (2018).

## SOFTWARE

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### **ASTERIA Photometry Pipeline**

2020

[Github](#)

*Python*

Analysis pipeline built in Python to process raw ASTERIA data and produce time-series photometry data. Contributed significant modifications.

### **K2-25: Transit photometry analysis pipeline**

2017 - 2019

[Github](#)

*Python*

Analysis pipeline built to process 22 transit files of eccentric planet K2-25b, using an MCMC process to fit orbital parameters to the data. Also included are supplementary scripts and Jupyter Notebooks used throughout the research project.

### **vicegui: Web-hosted user interface for VICE++ FPGA board.**

2019

[Github](#)

*Python, JavaScript*

Web GUI for FPGA built using Vue webpack instance, hosted on Python Flask server.

### **H4DAQ: Data acquisition system for H4 test site.**

2019

[Github](#)

*C++, VHDL*

Run-control software for test data acquisition setup, adjacent to SPS test beam. Contributed significant modifications and debugging.

## MENTORSHIP AND SCIENCE OUTREACH

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### **Mentorship**

Fall 2021 - Present

Serve as a dedicated mentor to undergraduate physics and astronomy students by meeting 1-on-1 weekly, as well as guerilla mentor for undergraduates who need short-term guidance.

### **Ask An Astronomer**

Fall 2021 - Present

Respond to questions from the public sent to [askanastronomer@ucolick.org](mailto:askanastronomer@ucolick.org), averaging two in-depth exchanges (~600 words) per week.

### **Public talks**

Fall 2021 - Present

Speak to public and university audiences about astronomical instrumentation and exoplanet science, including through undergraduate science clubs, SkypeAScientist, and classroom visits to local schools in Santa Cruz. I have given a total of 15 talks during graduate school.

## REFERENCES

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### **Prof. Andrew Skemer**

*Assistant Professor of Astronomy and Astrophysics, UC Santa Cruz*  
[askemer@ucsc.edu](mailto:askemer@ucsc.edu)

### **Dr. Renate Kupke**

*Instrument Scientist, University of California Observatories*  
[rkupke@ucolick.org](mailto:rkupke@ucolick.org)