

Ashley D. Baker

INSTRUMENT SCIENTIST

California Institute of Technology
Caltech Optical Observatories

☎ (704)-678-6831 | ✉ abaker@caltech.edu | 🏠 ashbake.github.io | 📺 ashbake | 🌐 ashbake

Appointments & Education

Instrument Scientist

CALTECH OPTICAL OBSERVATORIES

Pasadena, CA

June 2022 - Present

51 Pegasi b Postdoctoral Fellow

CALTECH

Pasadena, CA

May 2020 - June 2022

PhD in Physics & Astronomy

UNIVERSITY OF PENNSYLVANIA

Philadelphia, PA

Aug 2014 - May 2020

B.S. in Physics

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Minors in Math and Arabic, Highest Honors, GPA 3.7

Chapel Hill, NC

Aug. 2010 - May 2014

Research Interests

Advancements in astronomical instrumentation with a focus on precision radial velocity measurements of exoplanets, diffraction-limited observations, and detector characterization.

Fellowships, Grants, & Awards

PI of NASA Exoplanet Mass Measurement Program on Differential Limb Coupling (\$350,000)	2025
Co-PI on NSF MRI for the Keck 'IWA pyramid wavefront sensor	2025
Keck Institute for Space Studies Instrumentation Grant (\$80k)	2021
Troesh Prize Postdoctoral Fellowship	2020
51 Peg b Fellowship in Planetary Astronomy	2020
The Zaccheus Daniel Graduate Fellowship	2019
The Arnold M. Denenstein Prize - <i>for most promising experimental physics graduate student</i>	2018
National Science Foundation Graduate Research Fellowship	2016
Sigma Xi Grant-in-Aid of Research	2014

Teaching and Mentorship

Andrea Lin, Caltech Postdoctoral Fellow	2024-Present
Yan Terrien, Caltech VURP Student	2025
William Melby, Caltech SURF Student	2024
Huihao Zhang, Caltech SURF Student	2023
Tahamid Uzair Siam, Caltech SURF Student	2021
Physics Lab Teaching Assistant	2014-2020
Upward Bound Tutor	2015-2020

Service

Hubble Postdoctoral Fellowship Reviewer	2026
PASP Reviewer, JATIS Reviewer	2025
International Journal of High School Reviewer	2025
TESS TAC panel member	2021
Tea Talk Astronomy Seminar Organizer	2021

Select Publications

Mitigating differential limb coupling as an RV error term in diffraction-limited spectrographs on large telescopes

DOI 10.1117/12.3017288

ASHLEY D. BAKER, GARRETH RUANE, NEMANJA JOVANOVIĆ, ET AL.

2024

Differential high-precision photometry with narrowband filters using HIRAX: instrument overview

DOI 10.1117/12.3017296

ASHLEY D. BAKER, UZAIR TAHAMID SIAM, NEMANJA JOVANOVIĆ, ET AL.

2024

Overview and status of the front-end instrument (FEI) Keck/HISPEC, the diffraction-limited y-K band spectrograph for exoplanet characterization

DOI 10.1117/12.3020536

NEMANJA JOVANOVIĆ, ASHLEY D. BAKER, MITSUKO ROBERTS, ET AL.

2024

A UV double pass spectrograph for monitoring stellar activity for the Keck Planet Finder

DOI: 10.1117/12.2628149

ASHLEY D. BAKER, STEVE GIBSON, ET AL.

2022

The IAG Solar Flux Atlas: Telluric Correction with a Semi-Empirical Model

ApJS, 247, 1

ASHLEY D. BAKER, CULLEN H. BLAKE, ANSGAR REINERS

2020

The Oxyometer: A Novel Instrument for Exoplanetary Atmospheric Characterization

PASP, 131, 1000

ASHLEY D. BAKER, CULLEN H. BLAKE, SAM HALVERSON

2019

Monitoring Telluric Absorption with CAMAL

PASP, 129, 978

ASHLEY D. BAKER, CULLEN H. BLAKE, DAVID SLISKI

2017

Appointments and Work Experience

Instrument Scientist

Pasadena, CA

CALTECH OPTICAL OBSERVATORIES

July 2022 - Present

- Instrument scientist for HISPEC, a single-mode fiber fed spectrograph for Keck II. Leading the tracking camera cryostat design and assembly, detector characterization, and instrument simulations and trade studies.
- PI of HIRAX, prepping the multi-band photometer for on-sky verification testing.

51 Peg b Postdoctoral Fellow

Pasadena, CA

POSTDOC ADVISORS: DIMITRI MAWET & ANDREW HOWARD

July 2020 - July 2022

- Keck Planet Finder (KPF) science and instrument team member: building KPF's Ca H&K spectrometer, leading the KPF detector characterization data analyses, and developing data reduction pipeline modules
- HIRAX lead: Designing and building a multi-band photometer for characterization of exoplanet atmospheres to deploy and test at Palomar
- KPIC and PARVI instrument team member

Graduate Research Assistant

Philadelphia, PA

ADVISOR: CULLEN BLAKE

Dec. 2014 - May 2020

- Developed a unique telluric removal process for spectra; applied to high resolution solar spectra to make a new solar atlas and high resolution telluric repository
- Designed, tested, and analyzed the application of a novel ultra-narrow line, multi-band photometer for exoplanet atmospheric studies
- Built, programmed, installed, and coded the data reduction pipeline for an automated precipitable water vapor monitoring instrument called CAMAL
- Aided in the maintenance of MINERVA telescopes and electronics at Whipple Observatory

Kavli Summer Program in Astrophysics: Exoplanetary Atmospheres

Santa Cruz, CA

MENTOR: JASMINA BLECIC

Summer 2016

- Implemented a self-consistent parameterized cloud model into the exoplanet atmospheric retrieval code, PyRat Bay

UNC Chapel Hill Undergraduate Research Assistant

ADVISOR: SHEILA KANNAPPAN

Chapel Hill, NC

Nov. 2011 - May. 2014

- RESOLVE team member; assisted in conducting an astronomical survey of 1500 nearby galaxies; determined masses of galaxy groups and studied cluster environmental effects on galaxy properties

Condensed Matter Undergraduate Research

Chapel Hill, NC

ADVISOR: RENE LOPEZ

Jan. 2014 - May. 2014

- Designed photolithography masks to fabricate FETs in order to measure the electrical properties of PbS nanocrystals to improve quantum dot solar cell efficiencies

Select Presentations

SPIE Astronomical Telescopes & Instrumentation

Yokohama, Japan

ORAL PRESENTATION

July, 2024

- Mitigating differential limb coupling as an RV error term in diffraction-limited spectrographs on large telescopes

Chesapeake Bay Area Exoplanet Conference (CHEXO)

Washington, D.C.

ORAL PRESENTATION

January 24th, 2020

- The IAG Solar Flux Atlas: Telluric Correction with a Semi-Empirical Model

Caltech Seminar

Pasadena, CA

INVITED SPEAKER

November 26th, 2019

- Pushing the Limits of Ground-Based Exoplanet Characterization Surveys

University of the Sciences Colloquium

Philadelphia, PA

INVITED SPEAKER

January 31st, 2019

- The Oxyometer: A Novel Instrument Concept for Exoplanetary Atmospheric Characterization

American Astronomical Society 233rd Meeting

Seattle, WA

ORAL PRESENTATION

January 9th, 2019

- The Oxyometer: A Novel Instrument Concept for Characterizing Exoplanet Atmospheres

Exoplanet Science with Small Telescopes: Precise Radial Velocities

Philadelphia, PA

ORAL PRESENTATION

April 25th, 2017

- The Camera for the Automatic Monitoring of Atmospheric Lines

Kavli Summer Program in Astrophysics: Exoplanetary Atmospheres

Santa Cruz, CA

ORAL PRESENTATION FOR SUMMER PROJECT

Summer 2016

- Assessing Cloud Structure Using Parametrized and Self-Consistent Models in Retrieval

Outreach

Science Olympiad Mentor in Astronomy

Pasadena, CA

MENTORED TWO SCIENCE OLYMPIAD HIGH SCHOOL STUDENTS TO PREP FOR THE ASTRONOMY QUIZ.

2024, 2025

Astronomy on Tap

Pasadena, CA

PUBLIC TALK TITLED "HOW TO BUILD AND INSTRUMENT IN 365 DAYS TO STUDY EXOPLANET ATMOSPHERES"

July 11th, 2022

Astronomy on Tap

Philadelphia, PA

PUBLIC TALK TITLED "SEARCHING FOR THE SIGNATURES OF LIFE"

August 19th, 2019

UPenn Physics & Astronomy Outreach Coordinator

Philadelphia, PA

LED AND ORGANIZED DEPARTMENT OUTREACH ACTIVITIES

May 2015 - Dec 2018

Upward Bound Tutor

Philadelphia, PA

WEEKLY MATH TUTORING FOR VETERANS RETURNING TO SCHOOL

May 2015 - May 2019

Physics Lab TA

UPenn

TEACHING ASSISTANT

Aug. 2014 - May 2019

Observing Experience

PARVI

THE HALE TELESCOPE

Over 15 nights

The Keck Planet Finder (KPF)

KECK I TELESCOPE

- 5 nights of for commissioning activities.

Tillinghast 1.5m Reflector Telescope

TRES

- Two nights observing with the TRES instrument at Whipple Observatory.

Camera for the Automatic Monitoring of Atmospheric Lines

CAMAL

- Over 15 nights of observing to test filters, CCD capabilities, and optimize the instrument setup
- Wrote code to automate telescope slewing, CCD operation, target selection, and data reduction

SOAR Telescope (Goodman Spectrograph)

FOR THE RESOLVE SURVEY

- Over 15 full nights of remote observing requiring real-time analysis and target selection

Green Bank Telescope

FOR THE RESOLVE SURVEY

- On site and remote observing and data reduction of GBT galaxy spectra

Palomar Observatory

2022 - Present

Keck Observatory

Fall 2017

Whipple Observatory

Fall 2017

Philadelphia, PA

Jun 2015 - Present

UNC Chapel Hill

March 2012 - May 2014

UNC Chapel Hill

2013