Bryson Cale

Website: astrobc1.github.io Email: bryson.cale1@gmail.com LinkedIn: bryson-cale

GitHub: github.com/astrobc1

Education

George Mason University

Fairfax, VA 2017–2021

Ph.D., Physics

Dissertation: Retrieval and Applications of Precise Radial Velocities to Detect Exoplanets

Advisor: Dr. Peter Plavchan

Missouri State University

Springfield, MO

Master of Natural and Applied Science, transferred after one year

2016-2017

Grinnell College

Grinnell, IA

Bachelor of Arts, Physics & Mathematics

2012-2016

Advisors: Dr. Eliza Kempton, Dr. Karen Shuman

Interests

- Detection and characterization of extrasolar planets primarily through precise radial velocity measurements via Doppler spectroscopy.
- Development of robust mathematical modeling codes to solve a variety of unique challenges in astronomical data analyses and other scientific domains.
- Utilizing modern web technologies to visualize data products and analyses for a variety of scientific domains.

Employment

NASA Jet Propulsion Laboratory / IPAC

Pasadena, CA

NASA Postdoctoral Program (NPP) Fellow

2021-Current

- Characterizing the on-sky performance of a variety of high-resolution echelle spectrographs from around the world and utilizing them to detect exoplanets.
- Aiding in the commissioning of and characterizing the data products for PARVI, a single-mode fiber-fed spectrograph at Palomar Observatory.

George Mason University

Fairfax, VA

Graduate Research Assistant

2017-2021

- Developed a set of Python codes to aid in the confirmation of > 10 extrasolar planets via the radial velocity technique with a variety of echelle spectrographs.
- Logged >100 partial nights of observing with the iSHELL spectrograph on the NASA Infrared Telescope Facility.

George Mason University

Fairfax, VA

Academic Tutor

2017 - 2021

 Tutored George Mason University student athletes in a variety of introductory and upper-level physics, calculus, linear algebra, and computer science courses. Graduate Teaching Assistant

- Prepared lectures for and instructed students through three sections of an introductory astronomy lab course.

Technical Skills

- **Highly Proficient:** Python (Numpy+SciPy, plotting), Julia, language-agnostic data structures and design philosophies
- Experienced With: C, JavaScript (React+JSX, Svelte), HTML+CSS, Java, IDL, Scheme, PHP
- Authored Packages:
 - optimize: Tools for solving Bayesian Inference problems in Python.
 - * https://optimize.readthedocs.io/en/latest/
 - IterativeNelderMead.jl: A robust Nelder-Mead solver for non-linear regression in Julia with support for bounded parameters.
 - * https://astrobc1.github.io/IterativeNelderMead.jl/dev/
 - Echelle.jl: A set of Julia packages for processing echelle spectra and inferring the existence of extrasolar planets.
 - * https://astrobc1.github.io/EchelleDocs/
 - RVModelingToolkit.jl: A Julia package to model radial velocity observations with Keplerian orbits +
 Gaussian processes to infer the existence of extrasolar planets.
 - $*\ https://astrobc1.github.io/RVModelingToolkitDocs/$

Grants & Funding

- George Mason University Physics Department Summer Fellowship (2020), \$7.5K
- NASA Exoplanet Research Program Fellowship (XRP) (Co-I) (2019), 3-year stipend
- George Mason University Physics Department Summer Fellowship (2018), \$6K

Awarded Telescope Time

- 2022B: PARVI/Hale Commissioning Science with the Palomar Radial Velocity Instrument (PARVI). Co-I.
- 2022A: PARVI/Hale Commissioning Science with the Palomar Radial Velocity Instrument (PARVI). Co-I.
- 2021B: WIYN/NEID Radial Velocity Follow Up of Exoplanet Candidates Orbiting Cool Low Mass Stars Identified With TESS. Co-I.
- 2021B: IRTF/iSHELL Radial Velocity Follow Up of Extrasolar Planet Candidates Orbiting Cool Low Mass Stars Identified With TESS. PI.
- 2021A: IRTF/iSHELL Radial Velocity Follow Up of Extrasolar Planet Candidates Orbiting Cool Low Mass Stars Identified With TESS. PI.
- 2020B: HIRES/Keck Measuring Stellar Activity with Chromatic Radial-Velocities in the Active and Planet-Bearing Nearby M dwarf AU Mic. Co-I.

- 2020B: CHIRON/CTIO Measuring Stellar Activity with Chromatic Radial-Velocities in the Active and Planet-Bearing Nearby M dwarf AU Mic. Co-I.
- 2020B: IRTF/iSHELL Radial Velocity Follow Up of Extrasolar Planet Candidates Orbiting Cool Low Mass Stars Identified With TESS. PI.
- 2020A: IRTF/iSHELL Radial Velocity Follow Up of Extrasolar Planet Candidates Orbiting Cool Low Mass Stars Identified With TESS. PI.
- 2019B: CHIRON/CTIO Measuring Stellar Activity with Chromatic Radial-Velocities in the Active and Planet-Bearing Nearby M dwarf AU Mic. Co-I.
- **2019B**: IRTF/iSHELL RVx*TESS*: Spectral Studies of M Dwarfs with Simultaneous *TESS* and IRTF/iSHELL Observations. Co-I.
- 2019B: IRTF/iSHELL Radial Velocity Follow-up of Recently Discovered Transiting Planets Orbiting the Young and Active M Dwarf AU Mic. Co-I.
- 2019B: IRTF/iSHELL Radial Velocity Follow Up of Extrasolar Planet Candidates Orbiting Cool Low Mass Stars Identified With TESS. PI.
- 2019A: IRTF/iSHELL What Lies Beyond the TRAPPIST-1 Snow Line? Constraining Long Period Neptunes with iSHELL Radial Velocity Observations. Co-I.
- 2019A: IRTF/iSHELL Hidden Binaries in the Beta Pictoris Moving Group. Co-I.
- 2019A: IRTF/iSHELL Zodiacal Exoplanets In Time: Measuring the Masses of Young Exoplanets. PI.
- 2018B: IRTF/iSHELL Zodiacal Exoplanets In Time: Measuring the Masses of Young Exoplanets. PI.
- 2017A: IRTF/iSHELL What radial velocity precision is obtainable with iSHELL and the isotopic methane gas cell? Co-I.

Panels Served On

• NOIRLab Telescope Allocation Committee

Invited Talks

• Retreival and Applications of Precise Radial Velocities to Detect Exoplanets IPAC Seminar. February 2, 2022.

Conference Talks

- 2 Years of TESS Follow-up with iSHELL. Talk. 22nd TESS Science Team Meeting. 2020.
- Precise NIR RVs of Cool Low Mass Stars with iSHELL. Talk. Chesapeake Bay Area Exoplanet Meeting. 2020.
- iSHELL Data Analysis. Talk. Extreme Precise Radial-Velocities. 2017
- Precise Radial Velocity First Light Observations With iSHELL. Session Talk. 229th American Astronomical Society Meeting. 2017

Poster Presentations

- Precise Near Infrared Radial Velocities with iSHELL. Poster. 235th American Astronomical Society Meeting. 2020
- Precise Near Infrared Radial Velocities with iSHELL. Poster. Sagan Meeting Workshop Did I Really Just Find an Exoplanet?. 2018
- Precise Near IR Radial Velocity First Light Observations With iSHELL. Poster. 231st American Astronomical Society Meeting. 2018
- Transiting Exoplanet Observations at Grinnell College. Poster. 223rd American Astronomical Society Meeting. 2014

Publications

- Diving Beneath the Sea of Stellar Activity: Chromatic Radial Velocities of the Young AU Mic Planetary System. First Author. Published in Astronomical Journal. 2021.
- Precise Radial Velocities of Cool Low Mass Stars With iSHELL. First Author. Published in Astronomical Journal. 2019.
- Precise Near-Infrared Radial Velocities with iSHELL. First Author. White Paper submitted to the National Academies of Science. 2018.
- Transit Timing Variations for AU Microscopii b and c Co-Author. Published in Astronomical Journal. 2022.
- A Close-in Puffy Neptune with Hidden Friends: The Enigma of TOI 620. Co-Author. Published in Astronomical Journal. 2022.
- The Magellan-TESS Survey I: Survey Description and Mid-Survey Results. Co-author. Published in Astrophysical Journal. Teske et al. 2021.
- TOI-431/HIP 26013: A Super-Earth and a Sub-Neptune Transiting a Bright, Early K Dwarf, With a Third Planet Candidate. Co-author. Published in Monthly Notices of the Royal Astronomical Society. Osborn et al. 2021.
- Precise mass and radius of a transiting super-Earth planet orbiting the M dwarf TOI-1235: a planet in the radius gap? Co-author. Published in Astronomy & Astrophysics. Bluhm et al. 2020.
- A planet within the debris disk around the pre-main-sequence star AU Microscopii Co-author. Published in Nature. Playchan et al. 2020.
- Magnetism and spin-orbit alignment in the young planetary system AU Mic Co-author. Published in Astronomy & Astrophysics. Martioli et al. 2020.
- The CARMENES search for exoplanets around M dwarfs Two planets on the opposite sides of the radius gap transiting the nearby M dwarf LP 72954. Co-author. Published in Astronomy & Astrophysics. Nowak et al. 2020.
- TOI 442: The CARMENES search for exoplanets around M dwarfs: TOI 442.01=LP714-47b: Populating the Neptune desert. Co-author. Published in Astronomy & Astrophysics. Dreizler et al. 2020.
- A Hot Saturn Orbiting an Oscillating Late Subgiant Discovered By TESS Co-author. Published in Astronomical Journal. Huber et al. 2019

- TOI 257: A Warm Sub-Saturn on a Moderately Eccentric Orbit. Co-author. Published in Monthly Notices of the Royal Astronomical Society. Addison et al. 2021
- EarthFinder Report. NASA probe study report. Co-author. Plavchan et al. 2019
- Exo-Transmit: An Open-Source Code for Calculating Transmission Spectra for Exoplanet Atmospheres of Varied Composition. Co-author. Published in Publications of the Astronomical Society of the Pacific. Kempton et. al 2017.