# Bryson Cale

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## Education

**George Mason University** — Fairfax, VA
**Ph.D., Physics** — 2017–2021
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.

**Missouri State University** Springfield, MO
Graduate Teaching Assistant 2016–2017

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

## Skills

- **Highly Proficient:** Python (Numpy+SciPy, plotting), Julia, language-agnostic data structures and design philosophies, Mathematical modeling & Bayesian inference
- **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/
- Highly efficient at learning new languages, libraries, technologies, and concepts.

## 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. $22^{nd}$ 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. $229^{\text{th}}$ 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*. Plavchan 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.