

# Bryson Cale

Website: [astrobc1.github.io](https://astrobc1.github.io)  
Email: [bryson.cale1@gmail.com](mailto:bryson.cale1@gmail.com)  
LinkedIn: [bryson-cale](https://www.linkedin.com/in/bryson-cale)  
GitHub: [github.com/astrobc1](https://github.com/astrobc1)

## Education

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<b>George Mason University</b> <b>Ph.D., Physics</b> Dissertation: Retrieval and Applications of Precise Radial Velocities to Detect Exoplanets Advisor: Dr. Peter Plavchan	Fairfax, VA 2017–2021
<b>Missouri State University</b> Master of Natural and Applied Science, <i>transferred after one year</i>	Springfield, MO 2016–2017
<b>Grinnell College</b> <b>Bachelor of Arts, Physics &amp; Mathematics</b> Advisors: Dr. Eliza Kempton, Dr. Karen Shuman	Grinnell, IA 2012–2016

## Interests

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- 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.
- Utilizing modern web technologies to visualize data products and analyses for a variety of scientific domains.

## Employment

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<b>NASA Jet Propulsion Laboratory / IPAC</b> NASA Postdoctoral Program (NPP) Fellow <ul style="list-style-type: none"><li>– Characterizing the on-sky performance of a variety of high-resolution echelle spectrographs from around the world and utilizing them to detect exoplanets.</li><li>– Aiding in the commissioning of and characterizing the data products for PARVI, a single-mode fiber-fed spectrograph at Palomar Observatory.</li></ul>	Pasadena, CA 2021–Current
<b>George Mason University</b> Graduate Research Assistant <ul style="list-style-type: none"><li>– Developed a set of Python codes to aid in the confirmation of <math>&gt; 10</math> extrasolar planets via the radial velocity technique with a variety of echelle spectrographs.</li><li>– Logged <math>&gt; 100</math> partial nights of observing with the iSHELL spectrograph on the NASA Infrared Telescope Facility.</li></ul>	Fairfax, VA 2017–2021
<b>George Mason University</b> Academic Tutor <ul style="list-style-type: none"><li>– Tutored George Mason University student athletes in a variety of introductory and upper-level physics, calculus, linear algebra, and computer science courses.</li></ul>	Fairfax, VA 2017–2021

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

## Technical Skills

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- **Highly Proficient:** Python (Numpy+SciPy, plotting), Julia
- **Experienced With:** C, JavaScript (React+JSX) HTML+CSS, Java, Matlab, 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

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- 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

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- **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

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- NOIRLab Telescope Allocation Committee

## Invited Talks

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- *Retrieval and Applications of Precise Radial Velocities to Detect Exoplanets* IPAC Seminar. February 2, 2022.

## CONFERENCE TALKS

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- *2 Years of TESS Follow-up with iSHELL*. Talk. 22<sup>nd</sup> 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<sup>th</sup> American Astronomical Society Meeting. 2017

## Poster Presentations

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- *Precise Near Infrared Radial Velocities with iSHELL*. Poster. 235<sup>th</sup> 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. 231<sup>st</sup> American Astronomical Society Meeting. 2018
- *Transiting Exoplanet Observations at Grinnell College*. Poster. 223<sup>rd</sup> American Astronomical Society Meeting. 2014

## Publications

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- *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 729-54*. 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.