Bryson Cale

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Interests

- Development of astronomical data pipelines for optimal spectral extraction and spectral modeling.
- Detection and characterization of extra-solar planets.
- Characeterization of stellar-activity through Gaussian Processes and correlation with photometric measurements.
- Development of robust mathematical optimization codes with a focus on Bayesian inference and GUI's with a wide range of applications in data science.
- Contribution of robust and efficient algorithms for processing astronomical data in the Julia programming language.
- Develop unique algorithms to solve a variety of new and challenging problems.

Education

- **George Mason University** — **Fairfax, VA**
  Ph.D., Physics — *2017-2021*
  Areas of Study: Physics & Astronomy. *Dissertation: Retreival 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*
  Areas of Study: Physics, Astronomy, & Materials Science. Computer Science.
- **Grinnell College** — **Grinnell, IA**
  Bachelor of Arts — *2012-2016*
  Areas of Study: Double Major in Physics & Mathematics.
  Advisor: Dr. Eliza Kempton.

Employment

- **NASA Jet Propulsion Laboratory / IPAC** — **Pasadena, CA**
  NASA Postdoctoral Program (NPP) Fellow — *August 2021 - Current*
  - Developing a data pipeline for the new diffraction-limited PARVI spectrograph at Mt. Palomar to process raw echelle spectra, generate precise radial velocities, and model orbits.
  - Characterizing PARVI spectra and radial velocity precision.
  - Utilizing a variety of other spectrographs from around the world spanning visible and near-infrared wavelengths to detect exoplanets around.
- **George Mason University** — **Fairfax, VA**
  Graduate Research Assistant — *August 2017 - August 2021*
  - Developed codes to search for planets orbiting other stars via the radial velocity technique with a variety of modern echelle spectrographs.
  - Logged $>$ 100 partial nights of observing with the iSHELL spectrograph on the NASA Infrared Telescope Facility.
  - Aided in the confirmation of $>$10 exoplanet candidates identified with the NASA *TESS* Mission.
- **George Mason University** — **Fairfax, VA**
  Academic Tutor — *August 2017 - May 2021*

- Tutored George Mason University student athletes in physics, calculus, differential equations, linear algebra, and other upper level math, physics, and computer science courses.

- **Missouri State University** — **Springfield, MO**
  Graduate Teaching Assistant — *August 2016 - May 2017*
  - Prepared lectures for and instructed students through an introductory astronomy lab course.
  - Resource for NASA Public Observing Nights at MSU's Baker Observatory.

- **Grinnell College** — **Grinnell, IA**
  Physics Lab Teaching Assistant — *September 2015 - December 2015*
  - Guided students through an introductory physics lab.

Grants and 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

- **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.

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.**
- *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.

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. 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

Technical Skills

- **Highly Proficient:** Python (Numpy+SciPy, Streamlit, plotting), Julia
- **Experienced With:** C, Java, JavaScript, React (JS), Matlab, IDL, Scheme, HTML/CSS, PHP
- **Noteworthy Packages:**
  - **`optimize`:** An API for solving Frequentist+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://github.com/astrobc1/IterativeNelderMead.jl`
  - **`Echelle.jl`:** A suite of Julia packages for processing echelle spectra and inferring the existence of extrasolar planets.
    - `https://github.com/astrobc1/EchelleBase.jl`
    - `https://github.com/astrobc1/EchelleReduce.jl`
    - `https://github.com/astrobc1/EchelleSpectralModeling.jl`
    - `https://github.com/astrobc1/EchelleSpectrographs.jl`