

## Bryan Brzycki

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### Education

#### Harvard University

A.B. in Astrophysics and Physics. GPA: 3.78/4.0.

Scored 41 on the 2016 Putnam Competition.

Awarded NSF REU and Massachusetts Space Grant to conduct astrophysics research.

Cambridge, MA

May 2018

Summer 2017

#### California State University: Fullerton

Coursework in Mathematics, taken during high school. GPA: 4.0/4.0.

Fullerton, CA

September 2012 – May 2014

#### Troy High School

Valedictorian. GPA: 4.82/5 (Weighted).

Qualified for USAMO twice, placed within the top 40 the second time.

Placed 3<sup>rd</sup>, 5<sup>th</sup>, 6<sup>th</sup> in Astronomy at Science Olympiad Nationals, and 1<sup>st</sup> in all Regional and State Competitions.

Honorable Mention at the International Olympiad on Astronomy and Astrophysics (IOAA).

Fullerton, CA

May 2014

### Research Experience

#### Harvard-Smithsonian Center for Astrophysics

##### Research Intern

- Quantifying the energy contribution from magnetic fields in simulations of galaxy cluster mergers
- Comparing a suite of simulations with and without magnetic fields to analyze their impact on quantities of interest to X-ray observers, such as entropy

Cambridge, MA

September 2017 – Present

#### Maria Mitchell Observatory REU

##### Research Intern

- Used computer simulations, Python, and a suite of analysis tools to research the evolution of gas surrounding spiral galaxies.
- Worked with Blue Waters, the supercomputer at the University of Illinois at Urbana-Champaign, for the simulations and the subsequent analysis.
- Developed data products, or synthetic observations, from the simulations similar to those produced by actual observers.
- Continuing to analyze potential shortcomings of the simulation machinery, such as limited resolution or unphysical galactic structure.
- Created poster for presentation at the AAS meeting in January 2018

Nantucket, MA

June 2017 – Present

#### Harvard-Smithsonian Center for Astrophysics

##### Research Intern

- Derived theoretical constraints for pulsars in an Ultraluminous X-ray source (ULX), focusing on constraining the range of possible orbital and pulse periods, using physics and mathematical tools from Fourier analysis.
- Constructed simulations of pulsar light curve data using Python.
- Analyzed a set of the brightest known ULX sources for pulsations, using archived X-ray photon data from the XMM-Newton telescope to construct light curves and power spectra.
- Wrote a research proposal for funding through the Harvard College Research Program.

Cambridge, MA

June 2016 – December 2016

#### Caltech: Theoretical Astrophysics Including Relativity and Cosmology (TAPIR)

##### Research Intern

- Enhanced code intended to optimize gravitational wave extraction from a black hole collision simulation.
- Collected data from multiple simulations using the optimized code to analyze which parameters produced the most accurate gravitational wave extrapolations (to those using the precise but longer, computationally expensive simulation code).

Pasadena, CA

June – August 2013

#### California State University Fullerton Math Department

##### Researcher

- Worked on three unique math research projects, two concerning non-Euclidean geometry and the last using a combinatorial approach to prove a relationship between Fibonacci and Lucas numbers.
- Recently submitted a paper for publication, using a combinatorial approach to prove a relationship between Fibonacci and Lucas numbers.
- Published a paper on taxicab geometry and presented a poster at the 2013 Spring Regional MAA meeting.

Fullerton, CA

August 2012 – Present

- Coauthored another paper on non-Euclidean geometry and presented a short talk at the fall MAA SoCal/ Nevada Section meeting.
- Published a proposed geometry problem in the American Mathematical Monthly journal.

### **Summer Science Program**

Socorro, NM

#### **Researcher / Program Participant**

June 2012 – July 2012

- Wrote Python code to calculate the orbital parameters for a near-Earth asteroid based on Gauss' method.
- Observed asteroid and analyzed exposures using a professional telescope and software, such as MaximDL.

### **Leadership and Activities**

#### **USA Astronomy and Astrophysics Olympiad Foundation**

Fall 2013 – Present

##### **Founder, CEO and Treasurer**

- Organized the first US team for the IOAA, an international astronomy competition for high school students.
- Established the USA Astronomy and Astrophysics Olympiad Foundation to write and run national astronomy competitions to select a team of 5 students to compete at the IOAA.
- Entered partnership with the American Association of Variable Star Observers (AAVSO) for assistance with outreach and funding.
- Arranged for the first USAAAO summer training camp in 2016, a weeklong program at MIT for the 5 team members.

#### **Harvard University Math Department**

Fall 2015 – Present

##### **Course Assistant**

- Served as a course assistant for both Math 21a: Multivariable Calculus and Math 21b: Linear Algebra and Differential Equations.
- Assisted students during class time and during office hours every week.
- Advised teaching fellows on individual student progress and observations from grading and office hours.

#### **Maria Mitchell Association**

Summer 2017

##### **Observatory Guide**

- Help run public open nights, using the 24-in telescope to observe deep sky objects and teaching the public about astronomy
- Give tours of the observatory and its history during the daytime

#### **Student Astronomers at Harvard-Radcliffe**

Fall 2015 – Present

##### **Member / Observatory Manager**

- Help run club activities such as dark sky trips and observatory open houses.
- Maintain and keep inventory of Harvard's Loomis-Michael Observatory.

### **Publications**

Bryan Brzycki, On a geometric locus in taxicab geometry, Forum Geometricorum, 14 (2014) 117–121.

B. Brzycki, M. Giesler, K. Gomez, L.H. Odom and B. D. Suceavă. A ladder of curvatures for hypersurfaces in Euclidean ambient space, Houston Math. J. 40 (2014), 1347–1356.

### **Skills & Interests**

Technical: Experience with Python, C, C++, Java, OCaml, Git, and the UNIX shell.

Laboratory: Experience with MaximDL and using research telescopes. Experience with DS9, IRAF, XMM-Newton's SAS, and Chandra's CIAO. Worked with the Enzo simulation suite and yt analysis tools.

Interests: Music production, singing, poker, stargazing.