Will Barnes

NRC Postdoctoral Research Associate

Space Science Division, U.S. Naval Research Laboratory, Washington, D.C., USA

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Education

Rice University — *Houston, TX*

Ph.D. Physics — *2016 – 2019*

- Thesis: Diagnosing the Frequency of Energy Deposition in the Magnetically-Closed Solar Corona
- Advisor: Dr. Stephen Bradshaw

Rice University — *Houston, TX*

M.S. Physics — *2013 – 2016*

Baylor University — *Waco, TX*

B.S. Astrophysics — *2009 – 2013*

- Thesis: Astrophysical Applications of Dusty Plasma Physics, Advisor: Dr. Lorin Matthews
- University Honors Program, Magna Cum Laude, Phi Beta Kappa, Dean's List
- Minors: Mathematics, Great Texts of the Western Tradition

Experience

NRC Postdoctoral Research Associate — *Washington, D.C.*

U.S. Naval Research Laboratory — *January 2020 – present*

Visiting Postdoctoral Scholar — *Stanford, CA*

W. W. Hansen Experimental Physics Laboratory, Stanford University — *July – December 2019*

Exploring applications of HPC/cloud computing to analysis of HMI data

Postdoctoral Research Scientist — *Palo Alto, CA*

Lockheed Martin Solar and Astrophysics Laboratory, Bay Area Environmental Research Institute — *May – December 2019*

Developing workflows for analyzing AIA imaging data using HPC/cloud infrastructure in collaboration with Stanford U. and NASA Ames

Research Computing Intern — *Houston, TX*

Center for Research Computing, Rice University — *October 2018 – May 2019*

Developed web application for scheduled data transfers with Globus. Refactored high performance computing documentation in reStructuredText and Sphinx with interactive examples. Explored research applications for cloud computing.

Graduate Research Assistant — *Houston, TX*

Department of Physics and Astronomy, Rice University — *May 2014 – May 2019*

Investigated observable signatures of nanoflare heating frequency using hydrodynamic simulations of coronal loops, forward modeling, and machine learning

Papers

A current publication list is also available from Orcid (ID: 0000-0001-9642-6089).

Refereed Publications

2019 **Understanding Heating in Active Region Cores through Machine Learning II. Classifying Observations**, W. T. Barnes, S. J. Bradshaw, N. M. Viall, *in prep*

2019 **The SunPy Project: Open Source Development and Status of the Version 1.0 Core Package**, The SunPy Community, Will T. Barnes, Monica G. Bobra, Steven D. Christe, Nabil Freij, Laura A. Hayes, Jack Ireland, Stuart Mumford, David Pérez-Suárez, Daniel F. Ryan, Albert Y. Shih, et al., *ApJ (in press)*

2019 **Solar Active Region Heating Diagnostics from High Temperature Emission using the Marshall Grazing Incidence X-ray Spectrometer (MaGIXS)**, P. S. Athiray, Amy R. Winebarger, Will T. Barnes, Stephen J. Bradshaw, Sabrina Savage, Harry P. Warren, Ken Kobayashi, Patrick Champey, Leon Golub, Lindsay Glesener, *ApJ*, *doi: 10.3847/1538-4357/ab3eb4*

2019 **Understanding Heating in Active Region Cores through Machine Learning I. Numerical Modeling and Predicted Observables**, W. T. Barnes, S. J. Bradshaw, N. M. Viall, *ApJ*, *doi: 10.3847/1538-4357/ab290c*

2016 **Inference of Heating Properties from Hot Non-flaring Plasmas in Active Region Cores II. Nanoflare Trains**, W. T. Barnes, P. J. Cargill, S. J. Bradshaw, *ApJ*, *doi: 10.3847/1538-4357/833/2/217*

2016 **Inference of Heating Properties from Hot Non-flaring Plasmas in Active Region Cores I. Single Nanoflares**, W. T. Barnes, P. J. Cargill, S. J. Bradshaw, *ApJ*, *doi: 10.3847/0004-637X/829/1/31*

Conference Proceedings

2017 **ChiantiPy: A Python Package for Astrophysical Spectroscopy**, W. T. Barnes, K. P. Dere, *16th SciPy Conference*, *doi: 10.25080/shinma-7f4c6e7-011*

2013 **Dust Grain Growth in a Protoplanetary Disk: Effects of Location on Charge and Size**, W. T. Barnes, L. S. Matthews, T. W. Hyde, *44th LPSC*, *bibcode: 2013LPI....44.1897B*

Other Non-refereed Publications

2018 **Modeling Coronal Loops in 3D with sunpy.coordinates**, W. T. Barnes, *SunPy Blog*, *url: sunpy.org*

Research Fellowships Awarded

NRC Research Associateship Postdoctoral Fellowship — *Washington, D.C.*
Naval Research Laboratory, National Academies of Sciences — *January 2020 – present*
Awarded 1-year NRC postdoctoral fellowship to study observational signatures of thermal non-equilibrium in coronal loops

NASA Postdoctoral Program Fellowship (declined) — *Washington, D.C.*
NASA Goddard Space Flight Center, USRA
Awarded competitive NPP Fellowship to study physics of coronal heating; declined in favor of NRC postdoctoral fellowship

NSF REU Research Fellowship — *Waco, TX*
Baylor University, CASPER — *June – August 2012*
Received NSF REU fellowship to study dust grain charging and growth in protoplanetary disks.

Summer Undergraduate Research Fellowship — *Waco, TX*
Baylor University, Dept. of Physics — *June – August 2011*
Awarded summer research funding to investigate plasma physics of charged dust grains in Saturn's F Ring.

Professional Service

Reviewer for: The Astrophysical Journal

Python in Astronomy Conference 2020
Member of Scientific Organizing Committee — *20 – 24 April 2020*
Organize webpage, communicate meeting announcements to community, and assist in choosing program of speakers

SHINE Workshop
Discussion session co-organizer and co-chair (with S. Bradshaw and N. Viall) — *30 July – 3 August 2018*
Topic: Signatures of Time-dependent Heating in Active Regions and the Slow Solar Wind

SPD/AAS Congressional Visit Day
Student Representative — *25 June 2018*
Visited senators and representatives to lobby for increase in NASA heliophysics budget

Presentations

Conference Talks

Machine Learning in Heliophysics — *Amsterdam, The Netherlands*
Centrum Wiskunde and Informatica — *16 – 20 September 2019*
Seeing the Trees through a Random Forest: Details of Active Region Heating Revealed through Forward Modeling and Classification

Coronal Loops Workshop IX — *St Andrews, UK*
University of St Andrews — *11 – 14 June 2019*
Constraining the Frequency of Energy Deposition through Quantitative Comparisons of Models and Observations (invited)

Heliophysics Community Python Working Group Meeting — *Boulder, CO*
Laboratory for Atmospheric and Space Physics — *13 – 15 November 2018*
fiasco: a Python Interface to the CHIANTI Atomic Database

2018 SDO Science Workshop — *Ghent, Belgium*
Royal Observatory Belgium, Solar-Terrestrial Centre of Excellence — *29 October – 2 November 2018*
Understanding Heating Properties of Active Region Loops through Forward Modeling and Machine Learning

Triennial Earth-Sun Summit — *Leesburg, VA*
American Geophysical Union — *21 – 24 May 2018*
Timelag Analysis of Simulated Active Region Cores Heated by Nanoflares

Python in Astronomy 2018 — *New York City, NY*
Center for Computational Astrophysics, The Flatiron Institute — *30 April – 4 May 2018*
A Complete fiasco - The Difficulties of Dealing with Atomic Data and a Possible Pythonic Solution

16th Python in Science Conference — *Austin, TX*
SciPy, Enthought — *10 – 16 July 2017*
ChiantiPy: a Python package for Astrophysical Spectroscopy

Coronal Loops Workshop VIII — *Palermo, Italy*
INAF IASF Palermo — *27 – 30 June 2017*
Constraining Nanoflare Heating Frequency with a Global Active Region Model

AAS Solar Physics Division Meeting — *Boulder, CO*
American Astronomical Society — *31 May – 3 June 2016*
Hot Non-flaring Plasmas in Active Region Cores Heated by Single Nanoflares

Texas Undergraduate Astronomy Research Symposium — *College Station, TX*
Texas A&M University — *14 September 2012*
Dust Grain Charging in a Protoplanetary Disk

Seminars

Stanford Solar Group Science Meeting — *Stanford, CA*
Stanford University — *26 June 2019*
Seeing the Trees through a Random Forest: Details of Active Region Heating Revealed through Forward Modeling and Classification

Lockheed Martin Solar and Astrophysics Seminar — *Palo Alto, CA*
Lockheed Martin Solar and Astrophysics Laboratory — *20 June 2019*
Seeing the Trees through a Random Forest: Details of Active Region Heating Revealed through Forward Modeling and Classification

Space Physics Seminar Series — *Houston, TX*
Rice University — *19 November 2018*
Understanding Heating Frequency in Active Region Loops through Forward Modeling and Machine Learning

NRL Solar and Heliospheric Physics Branch Seminar — *Washington, D.C.*
Naval Research Laboratory — *11 July 2018*
Investigating Heating Frequency in Active Region Cores through Timelag Analysis of Forward Modeled Emission (invited)

Space Physics Seminar Series — *Houston, TX*
Rice University — *27 February 2017*
A Framework for Forward Modeling Solar Active Regions

Space Physics Seminar Series — *Houston, TX*
Rice University — *9 November 2015*
Impacts of Two-fluid Effects on Emission from Impulsively Heated Coronal Loops

Outreach

North Houston Astronomy Club Late Summer Gathering — *Conroe, TX*
Lone Star College-Montgomery Campus — *24 August 2018*
Why is the Sun So Hot? A Current Perspective on Coronal Heating

Posters

American Geophysical Union Fall Meeting — *San Francisco, CA*
American Geophysical Union — *9 – 13 December 2019*
The Sun at Scale: Interactive Analysis of High Resolution EUV Imaging Data on HPC Platforms with Dask

Solar Heliospheric and Interplanetary Environment (SHINE) Workshop — *Cocoa Beach, FL*
National Science Foundation — *30 July – 3 August 2018*
Using Synthetic and Observed Timelags to Constrain Nanoflare Heating Frequency in Active Region Cores

Rice Data Science Conference — *Houston, TX*
Rice University — *9 – 10 October 2017*
Timelag Analysis of Global Hydrodynamic Simulations of Active Regions in the Solar Corona

Solar Heliospheric and Interplanetary Environment (SHINE) Workshop — *Saint-Sauveur, Quebec, CA*
National Science Foundation — *24 – 28 July 2017*
Modeling Observable Signatures of Nanoflare Heating Frequency in Active Region Cores

Solar Heliospheric and Interplanetary Environment (SHINE) Workshop — *Santa Fe, NM*
National Science Foundation — *11 – 15 July 2016*
Understanding the Impact of Nanoflare Heating Frequency on the Observed Emission Measure Distribution

Coronal Loops Workshop VII — *Cambridge, UK*
Unversity of Cambridge — *21 – 23 July 2015*
Effects of Ion Heating on Emission Measure of Coronal Loops in Active Region Cores

Triennial Earth-Sun Summit — *Indianapolis, IN*
American Astronomical Society — *26 – 30 April 2015*
Nonnegative Matrix Factorization as a Method for Studying Coronal Heating

44th Annual Lunar and Planetary Science Conference *The Woodlands, TX*
Lunar and Planetary Science Institute *18 – 22 March 2013*
Dust Grain Growth in a Protoplanetary Disk: Effects of Location on Charge and Size

Honors and Awards

Nov 2018 **Metcalf Travel Award to the SDO Workshop**, Solar physics Division of the AAS
Nov 2017 **Scientific Image Contest (Second Place)**, Wiess School of Natural Sciences, Rice University
Jul 2017 **Outstanding Student Poster Award**, SHINE Workshop
May 2016 **William and Elva Gordon Fellowship**, Department of Physics and Astronomy, Rice University
May 2016 **Chuoke Graduate Student Award**, Department of Physics and Astronomy, Rice University
Apr 2015 **Studentship Travel Award for AAS Solar Physics Division Meeting**, Solar Physics Division of the AAS
Apr 2013 **URSA Scholars Week Outstanding Research Poster in Physics**, Baylor University
2009–2013 **President's Gold Scholarship**, Baylor University
2011, 2012 **Gordon K. Teal Scholarship**, Department of Physics, Baylor University
2010, 2011 **Herbert D. Schwetman Scholarship**, Department of Physics, Baylor University

Software and Computing

Skills

Languages	Bash, C, C++, IDL, Mathematica, MATLAB, Python
Scientific Computing	numerical methods, high performance computing (e.g. SLURM, PBS), parallel/distributed data processing
Markup	CSS, HTML, LaTeX, markdown, reStructuredText
DevOps	continuous integration, documentation, testing, version control

Open Source Contributions

A more complete record of my contributions is available on GitHub.

fiasco *2017 – present*
Maintainer *github.com/wtbarnes/fiasco*
fiasco provides a modern Python interface to the CHIANTI atomic database in addition to implementing many atomic physics calculations commonly used in solar physics. I am the creator and primary maintainer of fiasco.

SunPy *2016 – present*
Contributor *github.com/sunpy/sunpy*
SunPy is a library for solar data analysis in Python. I am an active member of the SunPy community and have made several contributions to the package. Specifically, I have worked to implement the widely-used AIA temperature response functions in SunPy.

ChiantiPy *2016 – 2017*
Contributor *github.com/chianti-atomic/ChiantiPy*
ChiantiPy is a Python interface to CHIANTI atomic database. My main contributions to ChiantiPy have been improving the documentation and packaging infrastructure and adding a test suite.

Teaching and Mentoring

Students Mentored

Lily Han *Rice University*
Undergraduate *October 2017 – April 2018*
Assisted in advising undergraduate thesis work on force-free field extrapolations and forward modeling

Brandon Wang *Clements High School*
High school intern *April 2017 – May 2018*
Advisor for STEM research course.

Tessa Wilkinson *Google Summer of Code*
Undergraduate *May – August 2016*
Mentor for project to implement AIA response functions in SunPy

Teaching Experience

PHYS 480/580: Introduction to Plasma Physics *Rice University*
Guest Lecturer *Fall 2018*
Gave guest lecture for introductory plasma course for senior undergraduate and graduate students. Topics covered included electrostatic waves, binary collisions, and motion in a uniform magnetic field.

ASTR 201: Stars, Galaxies, and the Universe *Rice University*

Guest Lecturer *Spring 2017*

Gave two guest lectures for non-majors astronomy course of approximately 70 undergraduate students. Topics covered included eclipses, phases of the moon, and the celestial sphere.

PHYS 102: Electricity and Magnetism *Rice University*

Lab Teaching Assistant *Spring 2014, Spring 2015*

Instructed lab sections of 40+ undergraduate students on topics including electrostatic interactions, magnetic induction, and basic circuits.

PHYS 101: Mechanics *Rice University*

Lab Teaching Assistant *Fall 2014, Fall 2015*

Instructed lab sections of 40+ undergraduate students on topics including kinematics, collisions, and simple harmonic motion.

Memberships

- American Astronomical Society, Solar Physics Division (Junior Membership)
- Phi Beta Kappa
- Sigma Pi Sigma