Will **Barnes**

NRC Postdoctoral Research Associate

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

✉ will.t.barnes@gmail.com | ⌂ https://wtbarnes.github.io | ⬚ wtbarnes | ✿ wtbarnes | ☞ Will Barnes

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

2020 **Understanding Heating in Active Region Cores through Machine Learning II. Classifying Observations**, W. T. Barnes, S. J. Bradshaw, N. M. Viall, *in prep*

2020 **SunPy: A Python Package for Solar Physics**, Stuart J. Mumford, Nabil Freij, Steven Christe, Jack Ireland, Florian Mayer, V. Keith Hughitt, Albert Y. Shih, Daniel F. Ryan, Simon Liedtke, David Pérez-Suárez, et al. (including Will Barnes), *JOSS*, *doi: 10.21105/joss.01832*

2020 **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*, *doi: 10.3847/1538-4357/ab4f7a*

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