Janvi Madhani

Curriculum Vitae

Personal Information

Name	Janvi P. Madhani
Date of Birth	*March 7, 1997*
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Education

Aug. 2015 – April 2019 **University of Pittsburgh** *Pittsburgh, PA*
B.S. in Physics and Astronomy, Honors Degree
Cumulative GPA: 3.577, Magna Cum Laude

Publications

Nov. 2019 https://arxiv.org/abs/1911.05841

Abstract (*abridged*) *(Madhani et al. 2019)* **:**

The results of an investigation into whether or not eclipse shadow bands have an atmospheric origin are presented. Using high altitude balloon and ground-based photodiode arrays during the 21 August 2017 total solar eclipse, data revealing the light patterns before and after totality were collected. These data were then analyzed using spectrograms. Both at the altitude of the balloon and on the ground, a sustained $\sim$ 4.5 Hz signal was detected a few minutes before and after totality. This signal was coherent over a scale greater than 10 cm and detected in four separate balloon photodiodes and 16 ground photodiodes. At higher frequencies, up to at least 30 Hz, brief chaotic signals that were disorganized as a function of time were detected on the ground, but not at the altitude of the balloon and appeared mostly uncorrelated over a length scale of 10 cm. Some of our ground arrays utilized red and blue filters, but neither the sustained 4.5 Hz signal nor the higher frequency signals showed a strong dependence on filter color. On the ground we made a video of the shadow bands on a scaled white screen. We judged that the bands were roughly parallel to the orientation of the bright thin crescent Sun before and after totality and inferred that their propagation velocity was about $v \sim$ 59 cm/s. Shadow band signals other than the sustained signal at $\sim$ 4.5 Hz are consistent with atmospheric scintillation theory. These results are surprising. Based on accounts in the literature we expected to confirm the atmospheric scintillation theory of eclipse shadow bands, but instead we detected a sustained $\sim$ 4.5 Hz signal at both high altitude and on the ground. This signal cannot be due to atmospheric scintillation and we ran a check to make sure this signal is not an artifact of our electronics. We recommend that additional searches for eclipse shadow bands be made at high altitude in the future.

Presentations and Talks

January 4-8, 2020 **235th Meeting of the AAS**
Honolulu, Hawaii
Poster
Future poster presentation about recent publication about observations of eclipse shadow bands.

March 18-20, 2019 **Atacama Cosmology 'f2f' Meeting**
Princeton,NJ
Talk
Short "fire-slide" presentation about research in cosmic rays and fast radio bursts.

March 25, 2018 **Department of Physics and Astronomy Undergraduate Poster Session**
University of Pittsburgh, Pittsburgh, PA
Poster
Poster presentation about progress in shadow band research.

March 16, 2018 **Public Lecture**
Allegheny Observatory, Pittsburgh, PA
Talk
Public lecture in collaboration with co-authors about research progress in understanding shadow bands.

September 22, 2017 **Allegheny Observatory's Open House**
Allegheny Observatory, Pittsburgh, PA
Talk
Opening talk of the open house about immediate findings from the data collected from the NASA eclipse project.

June 28, 2017 **Duquesne University's Summer Research Symposium**
Duquesne University, Pittsburgh, PA
Plenary Talk, Poster
20 minute plenary talk for all symposium attendees along with a poster presentation, both about shadow bands.

October 13, 2016 **White House Frontiers Astronomy Night**
Allegheny Observatory, Pittsburgh, PA
Demo, Poster
In relation to the NASA eclipse project, demonstrated imaging and video payloads, ballooning equipment, and shadow band detection setup along with a poster presentation in the presence of White House dignitaries and NASA personnel.

Awards, Honors, and Funding

Dean's List
Fall 2015 through Spring 2019

NASA - Pennsylvania Space Grant Consortium Scholarship
Summer '17, Fall '17, Spring '18, Fall '18, Spring '19

Research Experiences

Spring 2019 - Present **Developing A Theoretical Cosmological Model**
Pittsburgh, PA

- Dr. Arthur Kosowsky (P.I.)
- Testing Dr. Fulvio Melia's theoretical cosmological model that proposes a scale factor of the universe, $a(t)$, that increases linearly with time, rather than exponentially, as is argued for in standard ΛCDM cosmology. If Melia's model is true, then there would undoubtedly be consequences on the power spectrum of the Cosmic Microwave Background. Since this power spectrum is very precisely measured and observed, I am working on analytically and computationally testing his model for credibility against what has been measured and deduced from standard cosmology. Publication in preparation.

Sept. 2016 - Nov. 2019 **NASA Eclipse Ballooning Project**
Pittsburgh, PA

- Dr. David Turnshek (P.I.), Dr. Russell Clark, Lou Coban, Dr. Sandhya Rao, Dr. Jeffery Vipperman, Sinjon Bartel, Grace Chu, Carlos Vazquez Gomez, Marshall Hartman

- Studying the phenomena of shadow bands by means of a high altitude balloon during the 2017 total solar eclipse. Designed and created a shadow band simulator for use in lab, five photodiode circuits for use in balloon and on the ground and analyzed eclipse data in search of shadow bands in the upper atmosphere. Developed strong skills in mechanical and electrical engineering, programming, and signal processing. I am the first author on the publication presenting our results in which we conclude that shadow bands are not atmospheric in origin.

Spring 2018 - Spring 2019 **Searching for Fast Radio Bursts in Atacama Cosmology Telescope Data**
Pittsburgh, PA

- Dr. Arthur Kosowsky (P.I.)
- Developing software (written in Python) to automate the process of sorting through data recorded as glitches in order to identify possible candidates for Fast Radio Bursts (FRBs) in the microwave wavelength, and thus, constrain their origin. I have also successfully developed a pipeline to differentiate cosmic rays from glitch data. As we learn the interactions between cosmic rays and our detectors better, we will be further able to narrow down candidates for FRBs. This project is in collaboration with the Atacama Cosmology Telescope time-domain team at Princeton and Cornell University. Much of this pipeline can be found on my Github.

Teaching

Fall 2018 - Present **Tutor in the Dept. of Physics & Astronomy**
University of Pittsburgh, Pittsburgh, PA

Fall 2018 **Undergraduate Teaching Assistant for Quantum Mechanics I**
University of Pittsburgh, Pittsburgh, PA

Outreach

Public Outreach

October 2016, 2017, 2018, 2019 **Volunteer at Allegheny Observatory Open House**
Allegheny Observatory, Pittsburgh PA

- Volunteered the night of the open house each year to talk about general physics and astronomy and show demonstrations to the Pittsburgh community.

January 30, 2019 **Science Research Panel Speaker – Internship Week**
University of Pittsburgh, Pittsburgh PA

- Question - answer based panel about how I got involved in research and its impact on my future career goals.

Recorded Outreach

August 21, 2017 **Live Radio Interview with P.J. Maloney of KQV AM 1410**
Pittsburgh,PA

- Radio interview discussing the total solar eclipse and launching a high altitude balloon from the path of totality.

Skills

Programming

Python, Raspberry Pi, Arduino, LaTeX

Tools & Software

Git, MIRA (scientific image processing software), Matlab, SolidWorks

Professional Organizations

Member of American Physical Society (APS)

Member of Society of Physics Students

Languages

English *Fluent*
Gujarati *Fluent*
Hindi *Fluent*
French *Conversational*
Sanskrit *Read and Write Only*