
ASTR/PHYS Professional Development
Undergrad Research Opportunities Symposium:
Astrophysics, Planetary Science & Heliophysics
• Summer "Research Experience for Undergraduates" (REU's)
• Undergraduate Research Opportunities (UROP's)
• Independent Study
• ASTR 3400 "Research Methods"
• 15+ recruitment presentations by researchers in APS and associated units LASP, NSO, CASA and JILA
Tuesday, December 5th
6:30-8:00pm
Duane G1B20
Plus FREE PIZZA!

Welcome!

Please:

1. Add 1-2 slides to this deck, advertising a research opportunity for undergraduate students. Be clear about expectations, prerequisites, and application instructions.
2. Submit your job ad to the APS Undergraduate Research/Employment Opportunity form, to provide more equitable access to students seeking positions.
3. Show up on Tuesday, 5 December 2023 at Duane G1B20 to present your slide(s), or delegate someone else to present it for you (we happily volunteer).
4. If you're submitting a recording, please place a youtube link in your slides or email your recording to nick.schneider@lasp.colorado.edu

APS Undergraduate Research Opportunities Symposium

Open positions posted here

Recording here

Presenter Index here

5 December 2023 | 6:30pm | Duane G1B20

Nick Schneider & Paul Hayne

ASTR/PHYS Professional Development

Undergrad Research Opportunities and How to Get Them

- UROP Proposals for funded research
- Independent study with a CU researcher
- Research Experience for Undergraduates Summer programs (REU’s)
- Research-focussed coursework
- Faculty-mentored research
- Honors Theses

UROP's, Independent Study, Courses and REU's

Are you ready for research?	Nick Schneider
Undergrad Research Opportunities ASTR 3400 Research Methods ASTR 3560 Instrumentation	Nick Schneider Paul Hayne Brian Fleming
Research Experience for Undergraduates & the Boulder Solar Alliance REU REU listings	Willow Reed Nick Schneider

Click on presenter name to go to their slides
Slides may not appear in the same order as listed here

Speaker/Research Advisor	Organization	Research Topic
David Malaspina & Peter Tatum +	APS/LASP	Parker Solar Probe
Alex Chasapis & David Malaspina +	APS/LASP	Solar Wind Turbulence - Parker Solar Probe
Steven Cranmer +	APS/LASP	Why is the Sun's corona so hot? How is the solar wind accelerated?
Paul Hayne +	APS/LASP	Exploration of Planetary Ices and Climates
Katherine Kretke	SwRI	L'SPACE Program and other Opportunities at Southwest Research Institute
Alex Haughton +	APS/LASP	Technology development for UV Space Telescopes
Emily Griffith +	APS/CASA	Calculating stellar abundances of low metallicity stars
Xiangning Chu* +	LASP	Machine learning model to predict killer electrons in space.
Nick Schneider	APS/LASP	Aurora on Mars from MAVEN and the Emirates Mars Mission
Kyle Connour +	LASP	Mars imaging by Maven
Sumedha Gupta* +	LASP	Enhancing MAVEN Stellar Occultations
Erica Nelson	APS/CASA	Galaxies (+- dark matter) with JWST
John Keller	APS/Fiske	Fiske and RECON stellar occultation opportunities
Adam Kowalski & Adina Feinstein +	NSO and APS	Flares of Fury
Adrienne Pickerill +	LASP	Job Opportunities in LASP Space Flight Operations
Kevin Reardon & Sanjay Gosain	NSO	The eclipse is coming!
Serena Criscuoli +	NSO	Understanding Radiative Emission of the sun over all spatial scales
Ryan French +	NSO	Explosive Solar Flares
Xinlin Li + +	AES/LASP	Colorado Inner Radiation Belt Experiment (CIRBE) CubeSat
Naomi Maruyama +	LASP	Predicting Space Traffic Jams with high performance computer simulations
Brian Fleming +	APS/LASP	So you want to join a space mission?
Larry Esposito +	APS/LASP	Rings of Uranus and Neptune
Chihoko Cullens*	LASP	NASA's ICON mission

https://www.colorado.edu/aps/undergraduate-studies/professional-development

Professional Development

APS/PHYS Professional Development is a resource for undergrads in fields related to physics and astronomy at CU Boulder. This website includes resources and information designed to help undergraduates in APS/Physics develop successful longterm careers. This website is designed to offer resources and advice that will help you succeed in your career after graduating CU Boulder. Navigate with the following main sections:

Events for Academic Year 2023-2024

Past Events:

9 October, Grad school: recording, slides, flyer

30 October, Getting involved in Physics research: recording, flyer

13 November, Careers in Heliophysics: recording, slides, flyer

Note: All recordings can also be found here

Upcoming Events

Tuesday, 5 December, 6:30-8:30, G1B20: Getting involved in Astrophysical & Planetary research

Prospective Students
Current Courses
Degree Requirements
Honors Program
Mentoring
Scholarships
Research Opportunities
Help Room & Tutoring
CU Stars
Alumni Showcase
Professional Development
- Events
- Undergrad Opportunities
- Applying to Grad School
- Careers

Research Opportunities

Participating in scientific research can be a highly valuable and rewarding part of your undergraduate education here at CU. Many students develop their interests, skills and contacts by working on one or more projects during their time at university.

Working in a research program can also be a significant help in ensuring success in your post-graduation plans. Research experience is highly recommended for those who are considering post-graduate academic programs, and can help you decide whether this is the right path for you. For any career path, a research advisor can provide letters of reference and valuable contacts. Being able to describe your research accomplishments can make your résumé a standout when applying for nearly any type of job after graduation.

Are you Ready for Research?

Students typically start to acquire useful skills, solidify their understanding of foundational math and physics concepts, and hone their interests after at least a year in our major. Below is a list of things you should consider, and steps you can take to help you get started.

You should keep in mind that finding research work may be competitive, and that resources may be tight (time for supervising your work, as well as pay). You will likely have to be patient and persistent to find a good match to your skill set and interests.

1. **Is your academic record solid?** If your GPA (either cumulative or in your math and science classes) is less than about 2.7-3.0, we STRONGLY suggest that you postpone an extracurricular activity like

Prospective Students
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Degree Requirements
Honors Program
Mentoring
Scholarships
Research Opportunities
APS Research/Employment Opportunities
Research and Internship Opportunities
Undergrad Research Symposium
Help Room & Tutoring
CU Stars
Alumni Showcase
Professional Development

Are you ready for research? Some Resources

https://www.colorado.edu/aps/undergraduate-students/ready-research

My OfficialFirstname (alternatename) LastName
My address in Colorado
Email: myofficial.cuaddress@colorado.edu

Education

Previous college-level education (CC, transfer, etc.) Semesters or dates
Major in ASTR, whichever track, Other majors, minors
Expected graduation date:
GPA (mandatory!): overall and in major, if available

Experience (list all relevant)

Research Assistant, Institution or Dept. Semesters or dates
what you did in three or four words
Supervisor:

Tutor, grader, LA, other teaching, Dept. Semesters or dates
Topics, in a few words
Supervisor:

Other relevant volunteer or paid work, Semesters or dates
incl. relevant extra-curriculars (CUAC, STARS, Fiske, SBO)
Topics and activities in a few words

Research Skills

Computer skills, computer courses taken (grade)
Data analysis skills including statistics, relevant courses taken (grade)
Experience with telescopes: which, what did you do, relevant courses (grade)
Laboratory or other useful skills, relevant courses taken (grade)

Awards and Recognition

Scholarships for CU or other colleges
Awards or other recognition at the college level

Other skills (if space): Something that makes you stand out
Bass player for heavy metal band
Chain-saw certification
Fluent in Serbo-Croatian

Reference: email@colorado.edu
Someone at CU who has agreed to be your reference. Can be mentor, instructor who knows you well

UROP

UNDERGRADUATE RESEARCH OPPORTUNITIES PROGRAM

COLORADO.EDU/**UROP**

Overview

We offer funding options, or grants, for students and faculty to develop projects in all areas of study and professional practice. Most undergraduates and faculty members are eligible for UROP funding, and we encourage you to contact us with questions.

Timeline

We fund projects throughout the year in two "grant terms," but applications are awarded annually in the spring. Students can check for “Open Opportunities” on our website and explore more in the Curiosity Lab at any time.

Student Grants

ASSISTANTSHIPS ($1,000-2,000) provide funding to students to partner with a faculty mentor to help on an existing project.

INDIVIDUAL GRANTS ($1,500-3,000) allow students to take ownership of part or all of a project with an original proposal.

Applications due Feb. 16, 2024.

Check the website for details!

Research Experience in Independent Study

- Earns academic credit but is not paid
- Usually 1-2 credits
- Research project jointly developed with a faculty* advisor
- Projects last one semester, with regular meetings through the semester
- Similar process to UROP, but less formal

* CU researchers serve as faculty research advisors

Research Experience for Undergraduates (REU) Programs

- The Research Experiences for Undergraduates (REU) program **supports active research participation by undergraduate students (enrolled Fall 2024) in any of the areas of research** funded by the National Science Foundation.
- REU projects **involve students in meaningful ways** in ongoing research programs or in research projects specifically designed for the REU program**.**
- These are **paid** research opportunities and the **REU site may be at either a US or foreign locations.**
- Undergraduate students supported with NSF funds **must be citizens or permanent residents of the United States** or its possessions.
- **Astronomical Sciences**, Chemistry, Earth Sciences, Materials Research, **Physics**, STEM Education, and more!

NSF's REU Sites Search

Willow Reed, bouldersolarreu@lasp.colorado.edu

Boulder Solar Alliance REU Program

- A **10 week paid research summer program** where students get to work on a research project with a mentor.
- The topic areas span the **field of solar and space physics**; the Sun, the Sun-Earth system, the near-Earth environment, the heliosphere, and more.
- The **BSA REU works in partnership with several institutes around Boulder**, including LASP, NSO, HAO, NOAA, and more!
- Applicants **do not** need prior research or coding experience to apply.

Applications due January 15th!

Boulder Solar Alliance
Research Experience for Undergrads
lasp.colorado.edu/home/reu

BSA REU Website

Willow Reed, bouldersolarreu@lasp.colorado.edu

My advice on applying to REUs (or anything really)

Make it clear why you want to be part of that specific program!

- You could be applying for a lot of great reasons - such as bettering your resume - but that can be achieved with any program. Why this one?

Start your applications early and give plenty of time to your references!

- Most applications are due between January - March, with references due around the same time. Don’t wait until the last minute!

Don’t be afraid to apply!

Willow Reed, bouldersolarreu@lasp.colorado.edu

Summer REU Opportunity Listings

NSF REU's:

Astronomy: https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5045

Physics: https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=69

APS information:

https://www.colorado.edu/aps/undergraduate-studies/research-opportunities/research-and-internship-opportunities

American Astronomical Society (AAS) information

https://aas.org/careers/internships-summer-jobs

Division for Planetary Sciences (AAS/DPS) information

https://dps.aas.org/education/reu-programs

(most planetary programs are not NSF-funded and do not appear in other listings)

Deadlines are coming up! Competition is strong. But go for it!

ASTR 3400: Research Methods (P. Hayne)

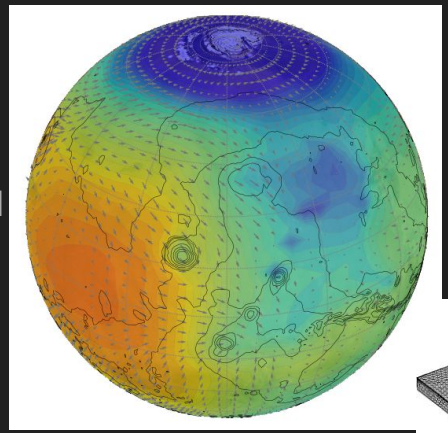
Purpose: Gain hands-on research experience in the classroom through guided project-based learning

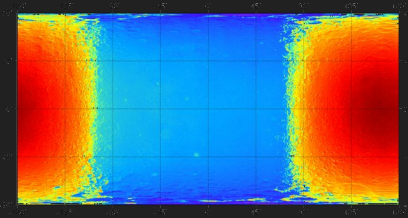
Topics covered: Scientific computing, data processing and analysis, numerical modeling, back-of-the-envelope calculations, reading the scientific literature, peer review, science communication, *and more!*

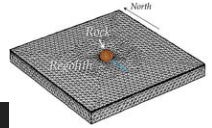
Focus for Spring ‘23: Planetary surfaces and atmospheres, remote sensing

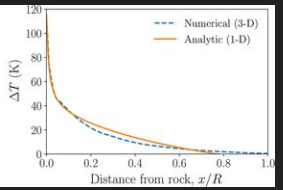
Previous terms have focused on: solar physics, black hole observations with EHT, asteroid occultation measurements with small telescopes

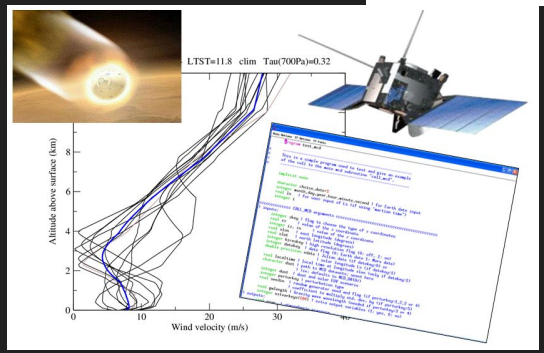
Prerequisites: ASTR 1040, PHYS 1125 or 1120, pre- or co-requisite of ASTR 2600 or PHYS 2600 (all minimum grade C-)











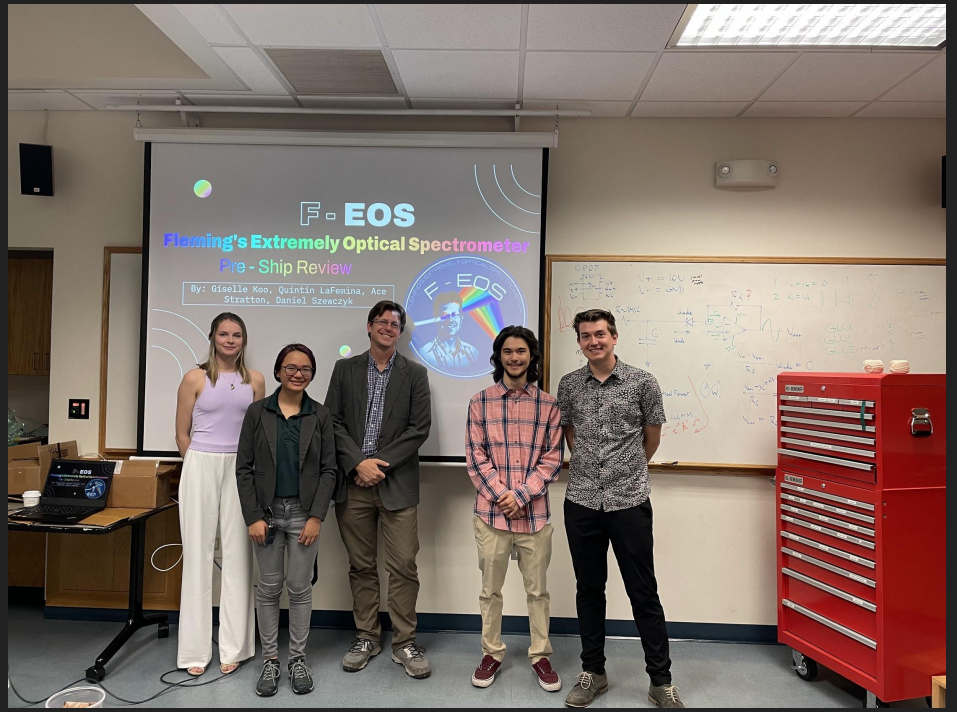
Examples of planetary datasets and models

So you think this is a little cool but aren't sure you want to join a space mission and/or work at a big ground-based observatory?

(then take a class…)

ASTR 3560

- Learn about optics!
- Play with lasers!
- Build your own detector!
- Project-based class – minimal lectures, lots of doing!
- No experience necessary – we will teach you how to understand astronomical instruments!
- You will leave this class with experience with experimentation and testing and exclamation points!



The first team ever (plus Professor) to build a spectrometer to measure the solar spectrum – F-EOS 2022

Can you be the second?

The National Aeronautics and Space Administration

L'SPACE

TRAINING OPPORTUNITY

FOR FUTURE SCIENTISTS, ENGINEERS, PROJECT MANAGERS, *AND ALL INTERSTED IN ADVANCING SPACE SCIENCE!*

SCAN ME

APPLY TODAY

LSPACE.ASU.EDU

Must be 18+ and enrolled in a US college or university as an undergraduate student.

SOUTHWEST RESEARCH INSTITUTE®

? Help

Job Posting Search

Enter search criteria below to search our job postings.

STEP 1: Choose an Employment Status

Salaried | Hourly | Internships

Seeking students currently enrolled in college.

STEP 2: Refine your search [optional]

Keywords

Work Location: Boulder, Colorado

Job Categories: All Categories

Job Title: Contains

SwRI

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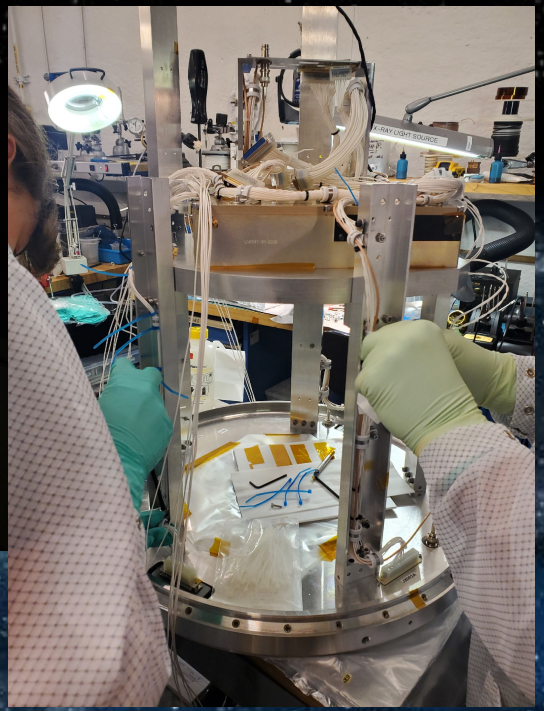
SCAN ME

katherine.kretke@swri.org

Get paid to do rocket science!

Work with space telescopes

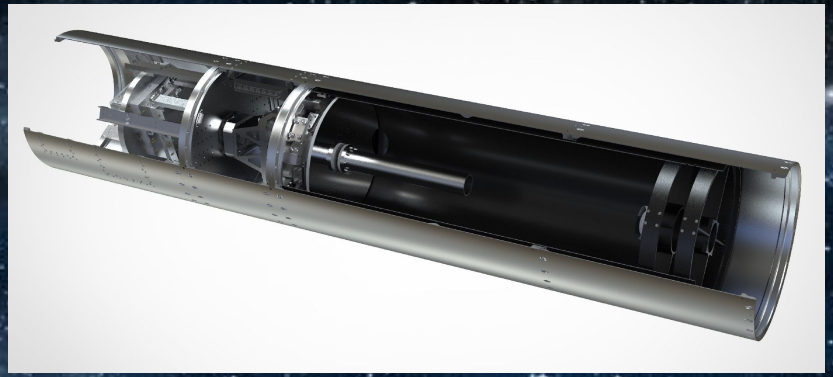
Develop electrical and mechanical lab skills



Software and data analysis work is also available

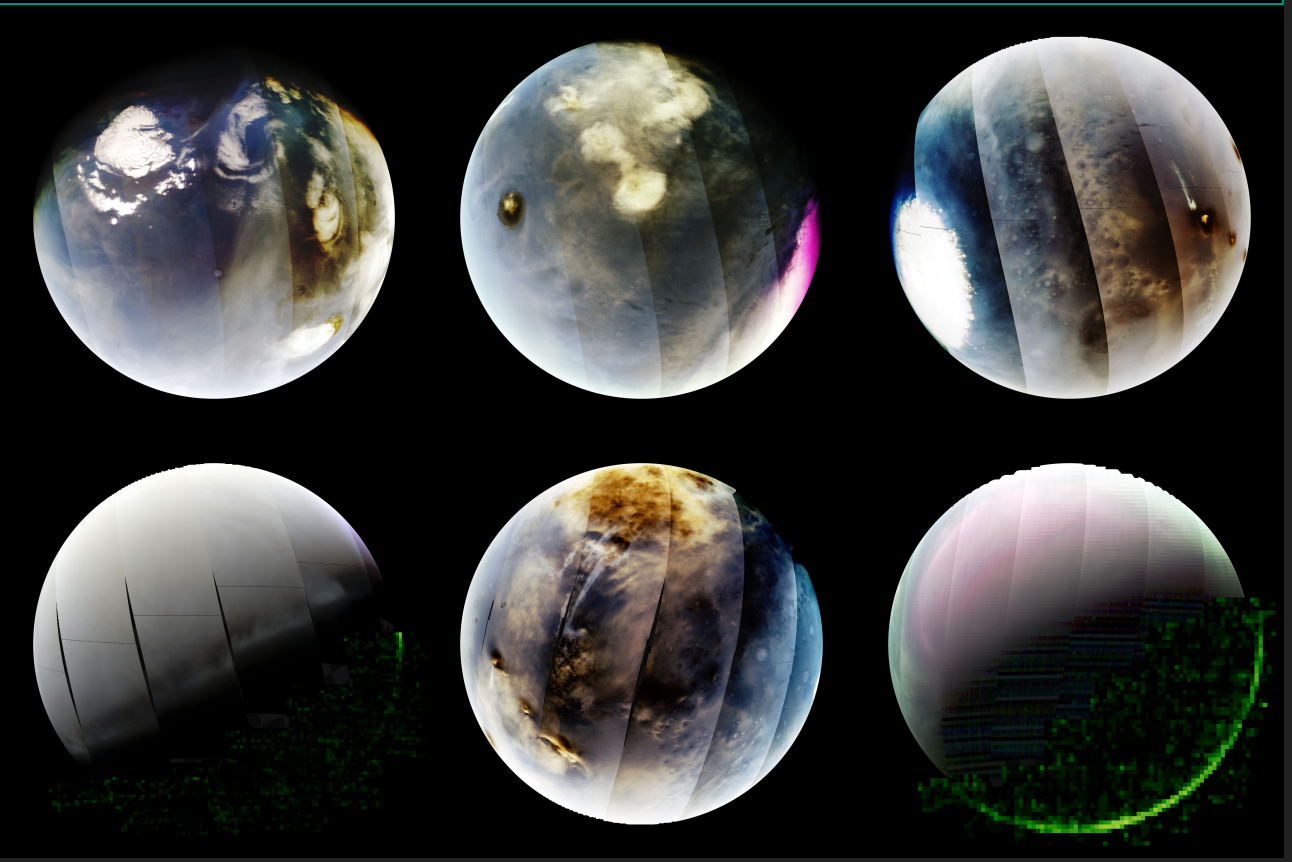
Send me a resume and your sales pitch

- Email: alex.haughton@colorado.edu
- Resume + 1-2 paragraphs on why you are interested and what you bring
- Due December 15th
- Hours and length are flexible



Mars imaging by Maven: overview

Kyle Connour: kyle.connour@colorado.edu



The IUVS instrument on MAVEN sees all sorts of atmospheric features. We want to make a timeline images showing everything IUVS has imaged.

The project also involves putting MAVEN data on LASP’s “Science in a Sphere”!!

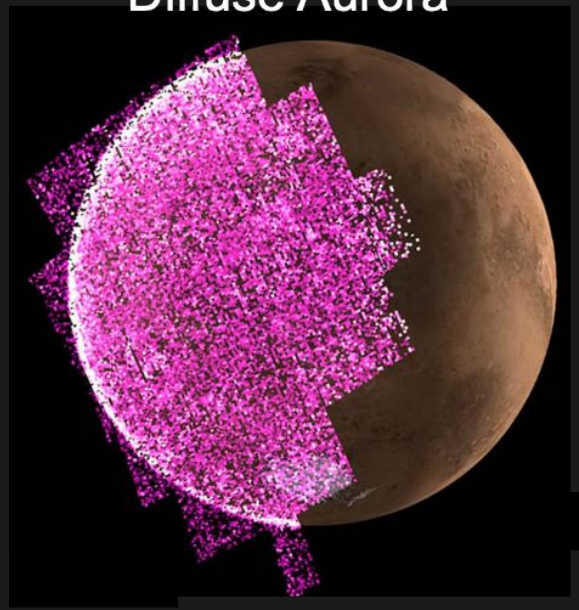
Mars imaging by Maven: Details

- This project is finite but there’s a possibility other projects related to MAVEN/IUVS could arise
- Ideal candidate qualities: Familiarity using Python (specifically numpy and matplotlib), familiarity with Mac/Linux, and interest in data visualization and mission design
- Paid? Yes. This project is not suited for an independent study project
- Time commitment: 10–20 hours/week until project is complete
- Application due date: Friday, December 15th

Meet the Auroras

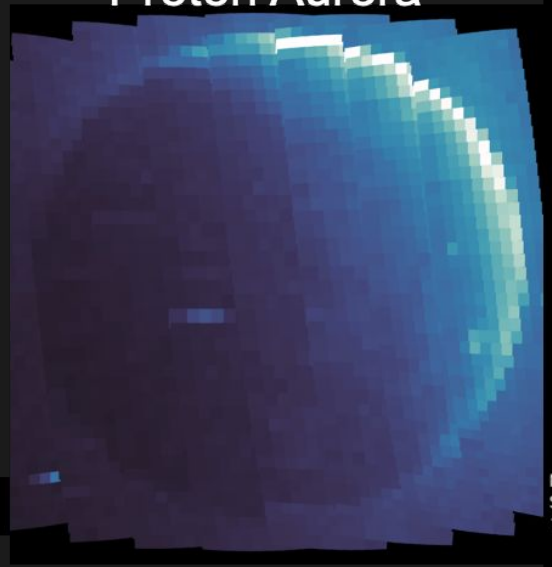
Three types observed by MAVEN's Imaging UltraViolet Spectrograph

Diffuse Aurora



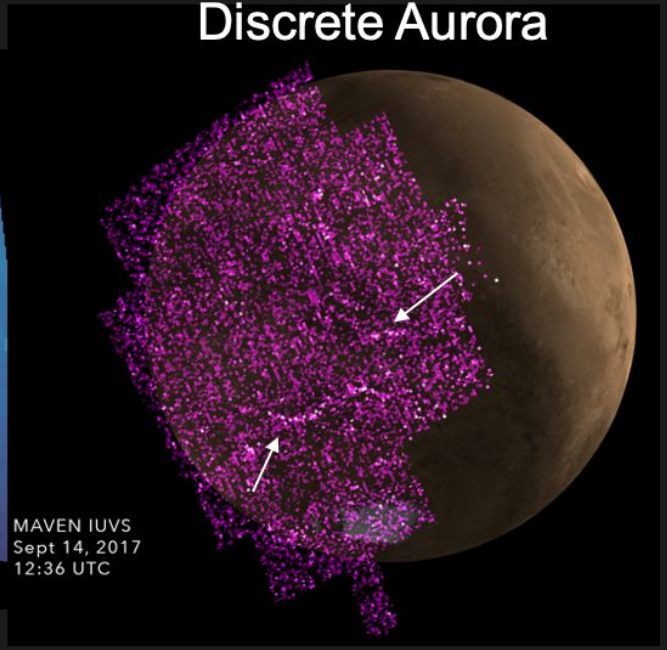
During strong space weather events, global aurora can engulf the planet, as in this image from September 2017

Proton Aurora

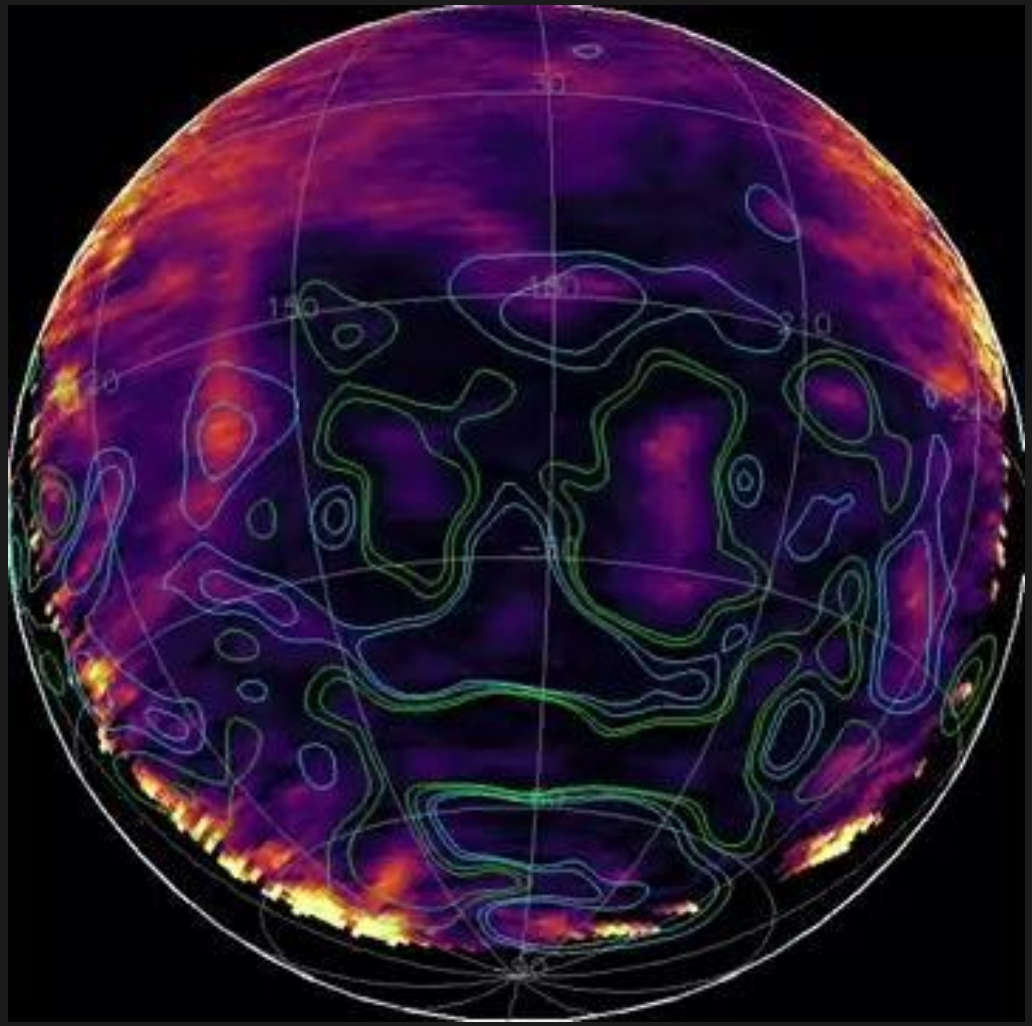


Solar wind protons penetrating Mar's atmosphere emit Lyman Alpha photons around the limb, adding to Mars' coronal glow

Discrete Aurora



Faint emissions form arcs around remanent magnetic fields locked in regions of Mars' crust, first seen by MEX/SPICAM



The MAVEN team is working closely with the Emirates Mars Mission UV spectral imager, which has obtained remarkably high sensitivity imaging of Mars “discrete aurora”.

The student’s primary effort will be examination of datasets from both missions to gain a greater understanding of aurora than possible with either mission alone

The work will emphasize computer graphics and scientific visualization

Aurora on Mars: Job & Application details

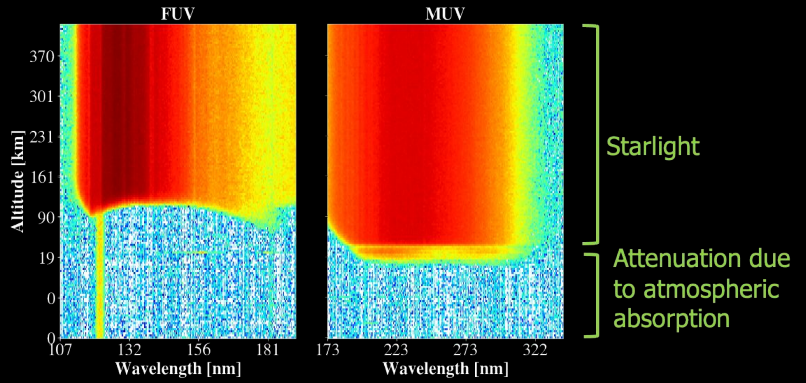
- Python experience/coursework required; with work data a plus
- Work involves image processing, spectral analysis, scientific visualization, and interpretation of results
- Previous undergrads have undertaken honors theses and gone on to good jobs & graduate programs

- To apply, email the following to nick.schneider@lasp.colorado.edu : a 1-page CV, your unofficial transcript and a one-page scientific graphic of your own creation, including a caption which explains its significance.
- Applications review starts 15 December

Enhancing MAVEN Stellar Occultations

Advisor: Dr. Sumedha Gupta (LASP)

Stellar occultations by MAVEN/IUVS continue to provide unprecedented data since 2015 to study Mars atmosphere by observing ultraviolet bright stars



Project: Help improve campaign planning by categorizing stars according to their usability

Enhancing MAVEN Stellar Occultations

Advisor: Dr. Sumedha Gupta (LASP)

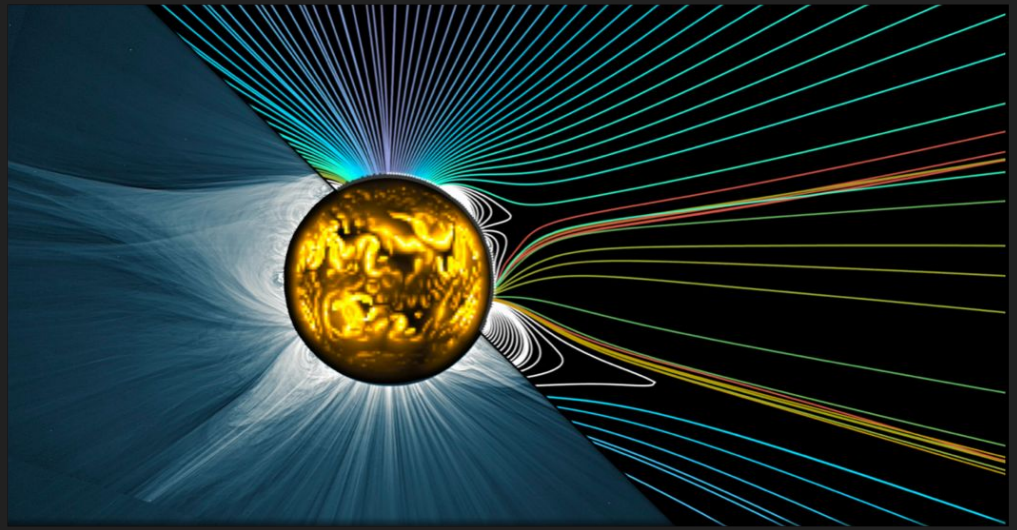
Job description	• Examine data quality of 3000+ MAVEN/IUVS stellar occultation observations and determine credibility of the retrieved products for different stars. • Work involves data handling, spectral analysis, statistics, and scientific visualization. • Other projects on MAVEN/IUVS stellar occultations may also arise.
Applicant skills	• Python experience/coursework required (specifically numpy, matplotlib) • Experience working with data desired • Interest in data visualization
Pay/Timeline	• Paid work - supported by **NASA MAVEN mission** • Starts in January for spring semester 2024 • Can be extended by mutual agreement • Time commitment: 10 hours/week

To apply	• Email the following to sumedha.gupta@lasp.colorado.edu
	  • 1-page CV
	  • 1-page scientific graphic of your creation with relevant caption and description of how you made it

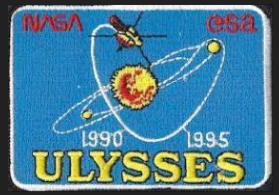
Application due date: December 12, 2023!

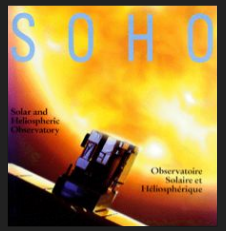
Why is the Sun's corona so hot? How is the solar wind accelerated?

A NASA-funded project with Prof. Steven Cranmer (CU/APS & LASP)



- These questions have been unanswered for almost 100 years, but it's not for a lack of theories!
- We have ***too many*** theories, and it's still difficult to figure out how to use ***observational data*** to rule out some of these proposed ideas.
- We'll gather data from "in situ" exploration over the past 50 years...





Why is the Sun's corona so hot? How is the solar wind accelerated?

A NASA-funded project with Prof. Steven Cranmer (CU/APS & LASP)

- **Job Description:** By assembling and analyzing data from multiple space missions, you'll help answer some fundamental questions about why the Sun's corona is so hot and why the solar wind accelerates through the solar system. We'll be building a database of the solar wind's properties to compare against new theoretical models.
- **Preferred Qualifications:** Basic Python coding (ASTR 2600 or equivalent) is preferred. Experience working with `numpy` arrays and making plots with `matplotlib` would be a bigger plus, as is having taken ASTR 3760 (solar & space physics) for familiarity with the topic.
- **Deadline:** 12/20/2023. To start in Spring 2024, possibly extendable to summer.
- **More about my research:** https://stevencranmer.bitbucket.io/
- **Email** me a CV & brief summary of coding experience: steven.cranmer@colorado.edu

FISKE
PLANETARIUM
University of Colorado Boulder

Our mission is to create innovative, immersive, and inclusive experiences to engage and inspire communities by connecting science, technology, and the arts.

Fiske Student Employment Opportunities

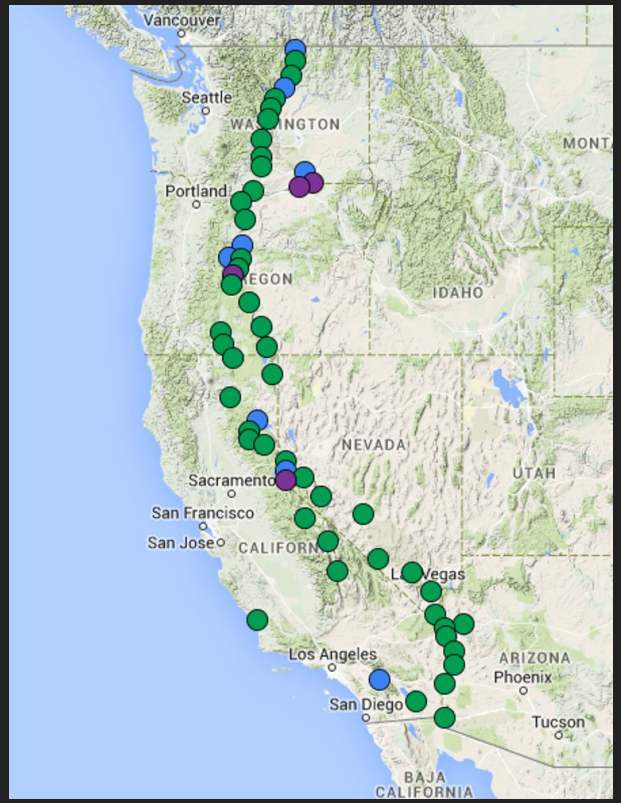
- Paid Student Positions at Fiske
  - Ushering
  - Ticketing
  - Navigating
  - Presenting
  - Producing
- To express interest in hiring opportunities
  - tinyurl.com/JoinFiske
  - Hiring typically in Jan, May, and Sept

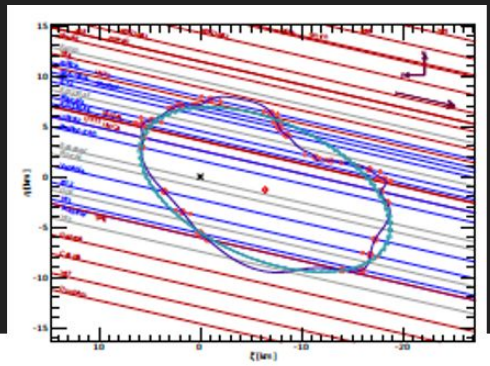
RECON 2.0 -
Research and Education Collaborative Occultation Network

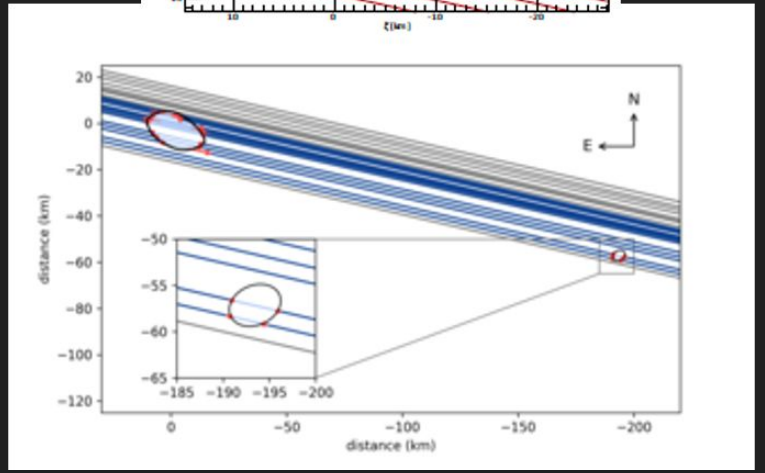
NASA SSO Award:

Solar system origins through Jupiter Trojan shapes

Shape and binarity for 100 Trojans







Parker Solar Probe Research Opportunity

Topic:

- Near-Sun solar wind impact on zodiacal cloud dynamics (how the sun processes its dust cloud)

Skills learned on the job:

- Spacecraft data analysis (Parker Solar Probe)
- Python coding
- Solar wind physics

Desired applicant skills:

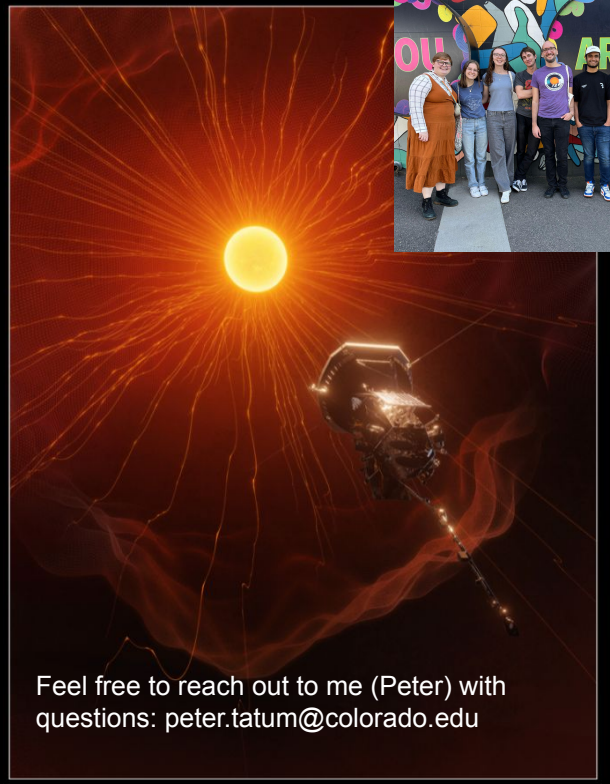
- Intro. Python coding (ASTR 2600 or equivalent)
- Clear written communication

Research group:

- LASP Solar Probe Research Group
- Faculty (David Malaspina)
  + Postdocs + Grad students + Undergrads

Timeline / Pay:

- Accepting applications until Dec 22, 2023
- Primary work: Summer 2024
  - Can be extended by mutual agreement
  - Summers: ~40 hr / week paid
  - Academic year: ~15 hr / week paid



Feel free to reach out to me (Peter) with questions: peter.tatum@colorado.edu

How to apply:

- email: David.Malaspina@colorado.edu
  - CV, list of courses taken
  - 1-2 paragraph expression of interest statement

Spacecraft Observations of Solar Wind Turbulence: Parker Solar Probe Research Opportunity

Topic: Study the structure of the turbulence of the solar wind using Parker Solar Probe spacecraft observations. Understanding what is heating the solar wind, and the physics of plasma turbulence.

Skills learned:

- Spacecraft data analysis (Parker Solar Probe)
- Solar wind & plasma turbulence physics

Desired applicant skills:

- Scientific Programming (Python/MATLAB)
- Written communication

Research group:

LASP Solar Probe Research Group

Advisors: Alexandros Chasapis, David Malaspina, Stefan Eriksson

Timeline/Pay

Applications until **22 December 2023**

Primary work:

- Spring 2024: 10-15 hr/week paid
- Summer 2024: 40 hr/week paid

How to Apply:

Email: alexandros.chasapis@lasp.colorado.edu

- CV, & list of relevant courses taken
- Brief statement of interest in the project (1-2 paragraphs)

Probing non-thermal processes in stellar flares

Project Description: Use new Hubble Space Telescope (HST) UV observations to characterize stellar flare atmosphere!

Skills Learned: python, generating and analyzing HST light curves

Desired Applicant Skills: Enthusiasm!

Application Materials: CV
Application Deadline: January 26, 2024
Nominal Start Date: Spring semester/summer 2024
Contact: adam.f.kowalski@colorado.edu & adina.feinstein@lasp.colorado.edu

Undergraduate Job Opportunities in Spaceflight Operations

CU's Laboratory for Atmospheric and Space Physics is hiring students for its Space Flight Operations Team. LASP currently operates two NASA missions, numerous payloads and SmallSats, and new projects are in development!

Students participate in all phases of a space mission (mission development, integration and test, launch, early orbit, routine operations, anomaly recovery, and end of life).

Job Responsibilities:

- Pre-launch environmental testing
- Real-time spacecraft operations
- Telemetry trending analysis
- Anomaly detection and resolution
- Process automation

Undergraduate Job Opportunities in Spaceflight Operations

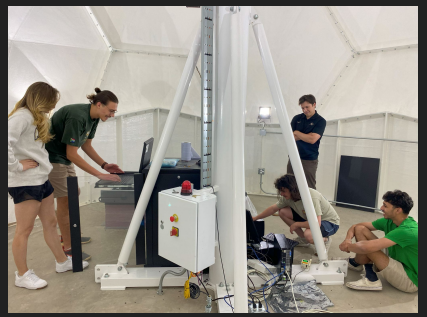
Requirements:

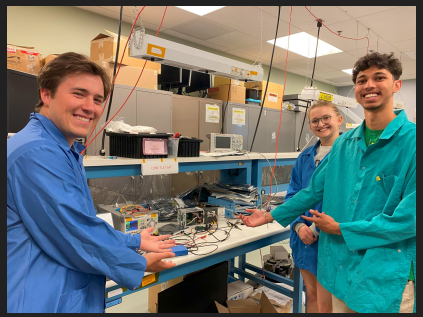
- Full-time CU student with 3.0+ cumulative GPA in good academic standing. All majors welcome to apply.
- At least 4 *undergrad* semesters remaining to commit to working at LASP
- Ability to commit to 40 hours per week during the summer *and* 20 hours per week during the school year (this is not a summer internship)
- Willingness to work occasional evenings and weekends
- US Citizen or Permanent Resident required

Logistics:

- Paid position
- Successful candidates can continue through grad school if they choose
- Application materials: resume, cover letter, unofficial transcript

Applications will open in January 2024 with info at https://lasp.colorado.edu/careers/

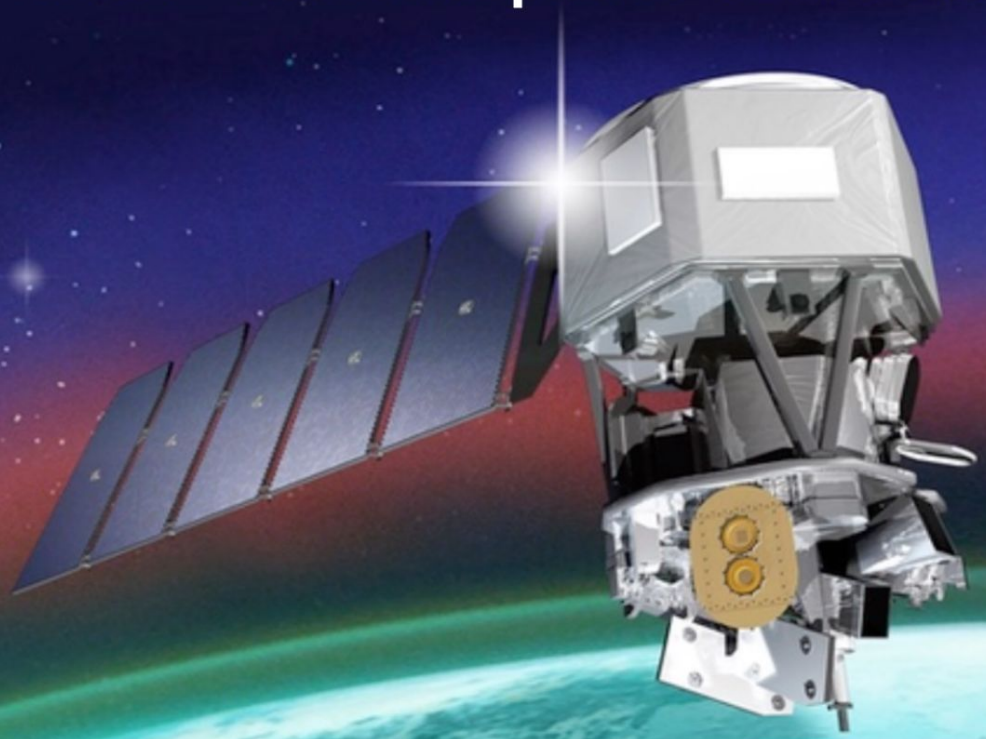




Contact Info:

Adrienne Pickerill, Grad Student Command Controller: adrienne.pickerill@lasp.colorado.edu
Robby Mendoza, Student Manager: raymond.mendoza@lasp.colorado.edu

NASA The Ionospheric Connection Explorer (ICON) Mission



The Ionospheric Connection Explorer (ICON)

- ICON is focusing on a region of space between 95 and 300 km above the Earth's surface (the ionosphere and the thermosphere).
- Launched: October 2019
- Instruments: MIGHTI, FUV, EUV, IVM

Contact
Chihoko Cullens (LASP)
Chihoko.Cullens@lasp.Colorado.edu

For more information about ICON, please visit:

https://icon.ssl.berkeley.edu

https://www.nasa.gov/icon

NASA the Ionospheric Connection Explorer (ICON) Mission

About Job

- Paid or independent study credit
- Expected to work 10-15 hours a week
- Once a week in-person meeting
- Previous programming experience preferred
- Starting date : January 2024
- Please apply (email CV/Resume) by February 10 to Chihoko.Cullens@lasp.Colorado.edu

Your Research Topic

- Your project will be to compare ICON-MIGHTI observations against the whole atmospheric simulations (SD-WACCMX model outputs).
- You will use Python codes to re-create satellite path and validate/compare model temperature and winds.

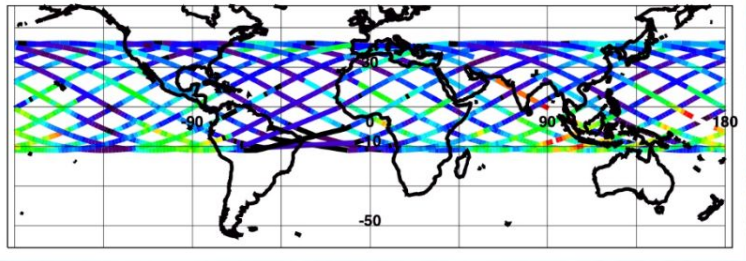


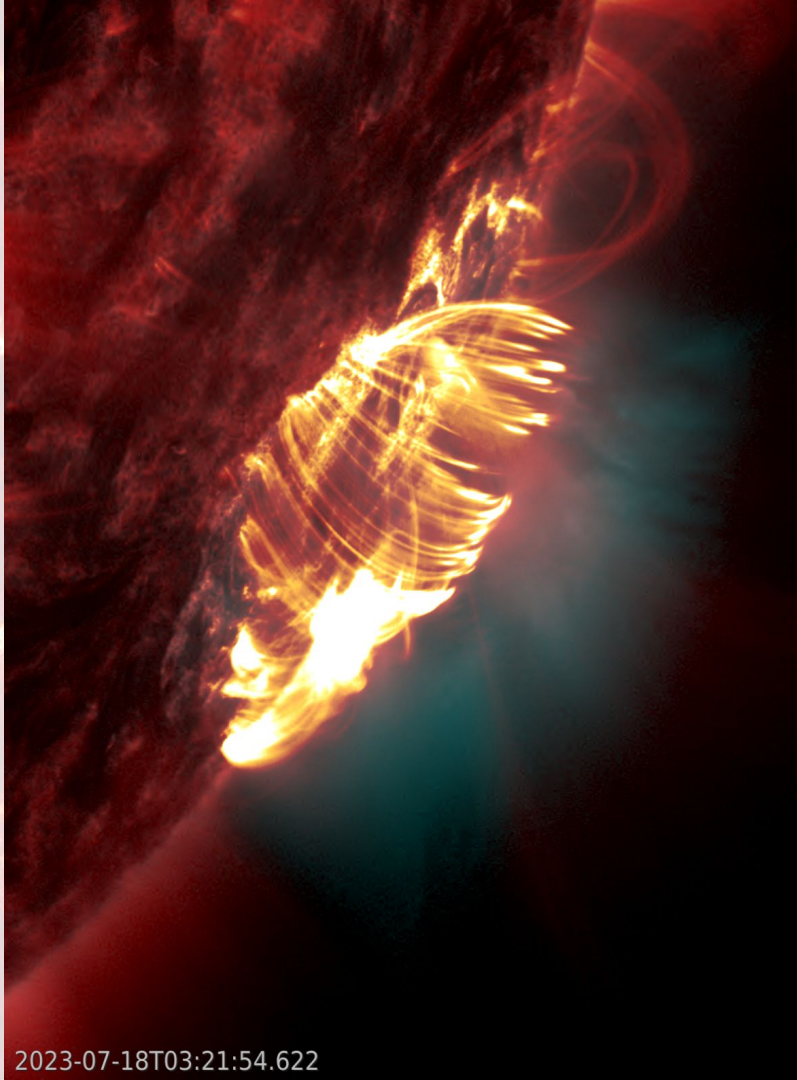
Figure 1. One day MIGHTI satellite measurements.

Explosive Solar Flares: Investigating SADs

Advisor: *Dr. Ryan French (National Solar Observatory)*

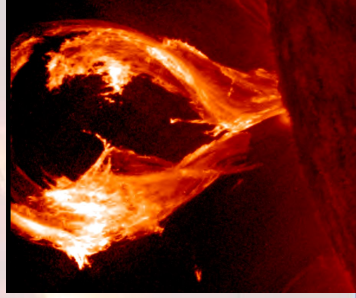
- Solar flares are the explosive conversion of energy in the Sun's atmosphere, and a key driver of *space weather*.
- Supra-Arcade Downflows (SADs) are frequently observed, but poorly understood phenomena in solar flares. Their link to energy release is uncertain.

Project: Build a database and produce a statistical study of SAD properties in solar flares. *(Project flexible, depending on applicants interests and coding experience)*



Explosive Solar Flares: Investigating SADs

Logistics



- Independent Study Credit
- Spring 2024 semester(?) (~10 hours a week), with potential opportunities for extension/funding (e.g. UROP) in the future.

Prerequisites: Enthusiasm to learn about the Sun and solar flares! Python experience an advantage.

To Apply: Email 1-page CV & *the following* to Ryan French at rfrench@nso.edu

1. Image/movie of a solar flare over the edge of the Sun, generated yourself using NASA SDO/AIA data in *Helioviewer* (web browser) **or** *JHelioviewer* (free software).
   (Search for events yourself, or utilize the 'Hinode Flare Catalogue').

Applications will be reviewed from **Dec 15th**, and continued until a suitable candidate found.

The eclipse is coming!

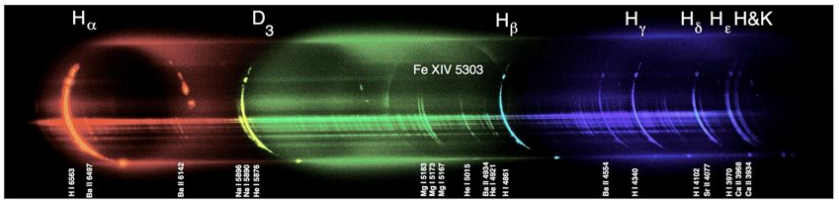
Kevin Reardon and Sanjay Gosain
kevin.reardon@colorado.edu

Desired Skills:

- Python coding experience
- 3-D modeling and printing
- Instrumentation

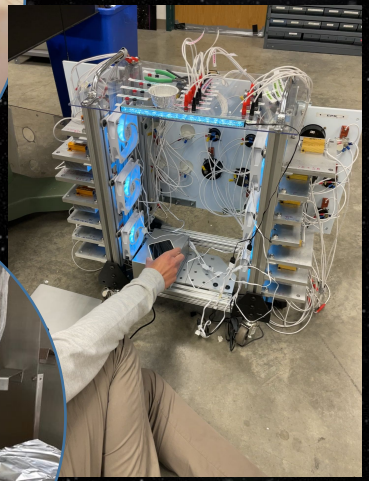
Position:

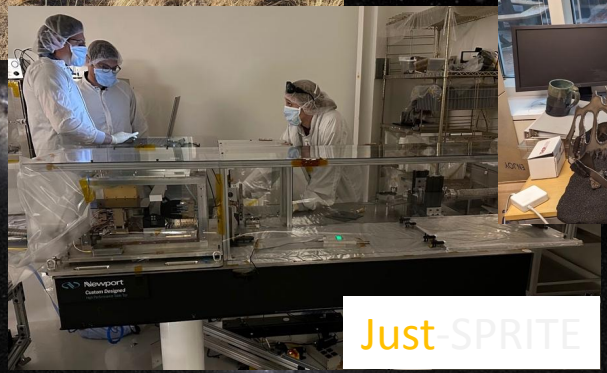
- Paid or independent study
- One semester or longer



So you want to join a space mission?

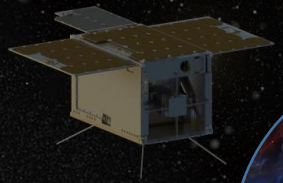
(you know you do…)

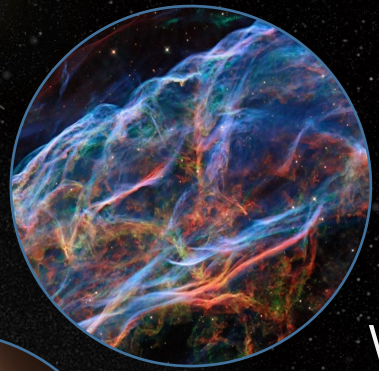


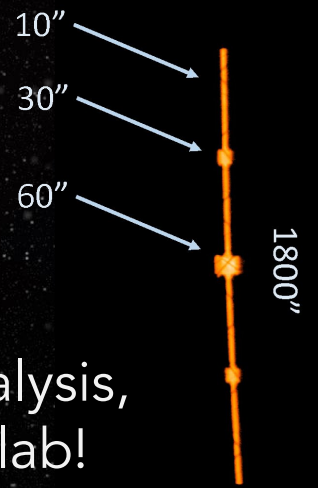


Advisor: Brian Fleming

Join the team and do lab work or data analysis



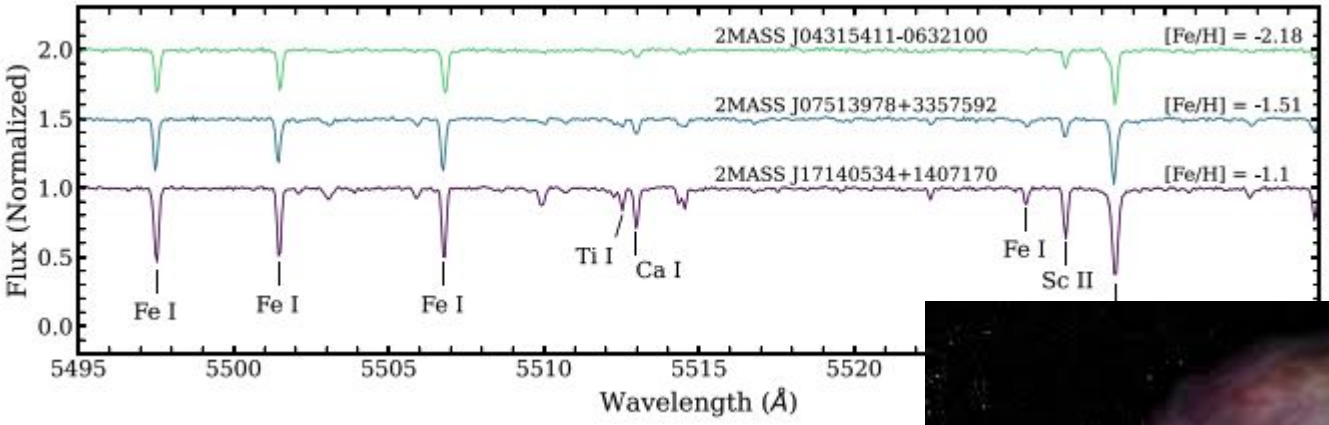




We need help with science data analysis, mission planning, and help in the lab!
You can do anything!

Experience Required: **None** (some science data analysis preferred for data analysis work)
Paid?: **Yes!**
Hours per week: **8-12** with Full Time summer available
Send 1 page resume to Brian.Fleming@Colorado.edu (And do it ASAP – Start in January)

Calculating stellar abundances of low metallicity stars



These elements are eventually captured in new stars that are born!

Core collapse supernovae (death of massive stars) release heavy elements into the ISM!

Calculating stellar abundances of low metallicity stars

Project Description: You will derive stellar abundances for heavy elements such as Y, Zr, Ba, La, and Ce for 100 metal poor dwarf stars! With this data, we will study how uniform vs. scattered the stellar abundances are to infer properties about core collapse supernovae.

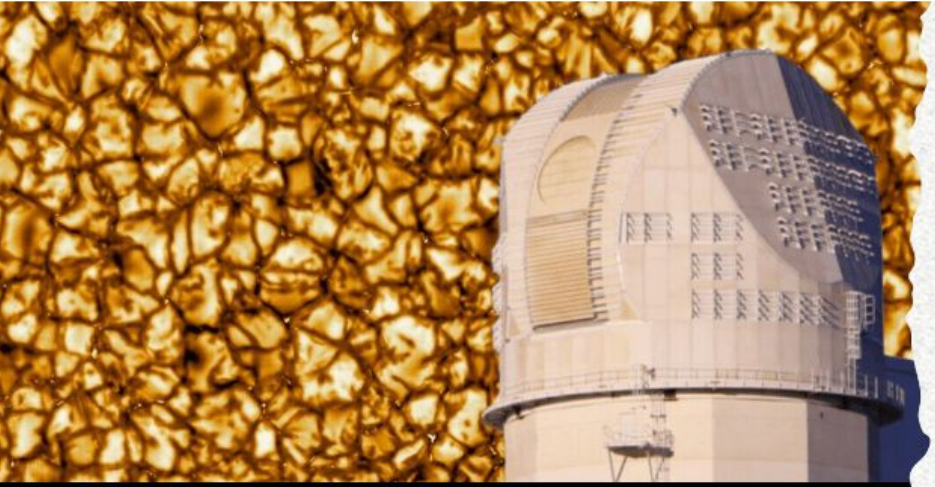
Skills Acquired: Python and Julia coding, knowledge of stellar atmosphere and stellar spectra, statistical analyses of ~large samples of data

Logistics: Paid position starting Spring 2024 (10 hrs per week) and continuing through Summer 2024 (30-40 hr per week). Open to Independent Study/UROP funding.

Desired Qualifications: Excitement for stellar astronomy and some coding experience.

How to Apply: Email Emily.Griffith-1@colorado.edu with your CV or resume and a paragraph about your interest in the project. We'll then schedule a time to talk 1 on 1.

Applications due by December 13th!



Understanding the radiative emission of the Sun, from the smallest scales to Sun-as-a-star

- Understand the effects of solar radiation on the Earth atmosphere and climate
- Understand stellar variability
- Exoplanets detectability and habitability

Serena Criscuoli
scriscuo@nso.edu

Analyze and compare CHASE and DKIST observations in Balmer lines, various projects:

Contact: Serena
scriscuo@nso.edu

- ❖ Instruments Intercalibration
- ❖ Detectability of CME in observations of Balmer lines
- ❖ Improvement of models
- ❖ Derive atlas of spectra of solar features

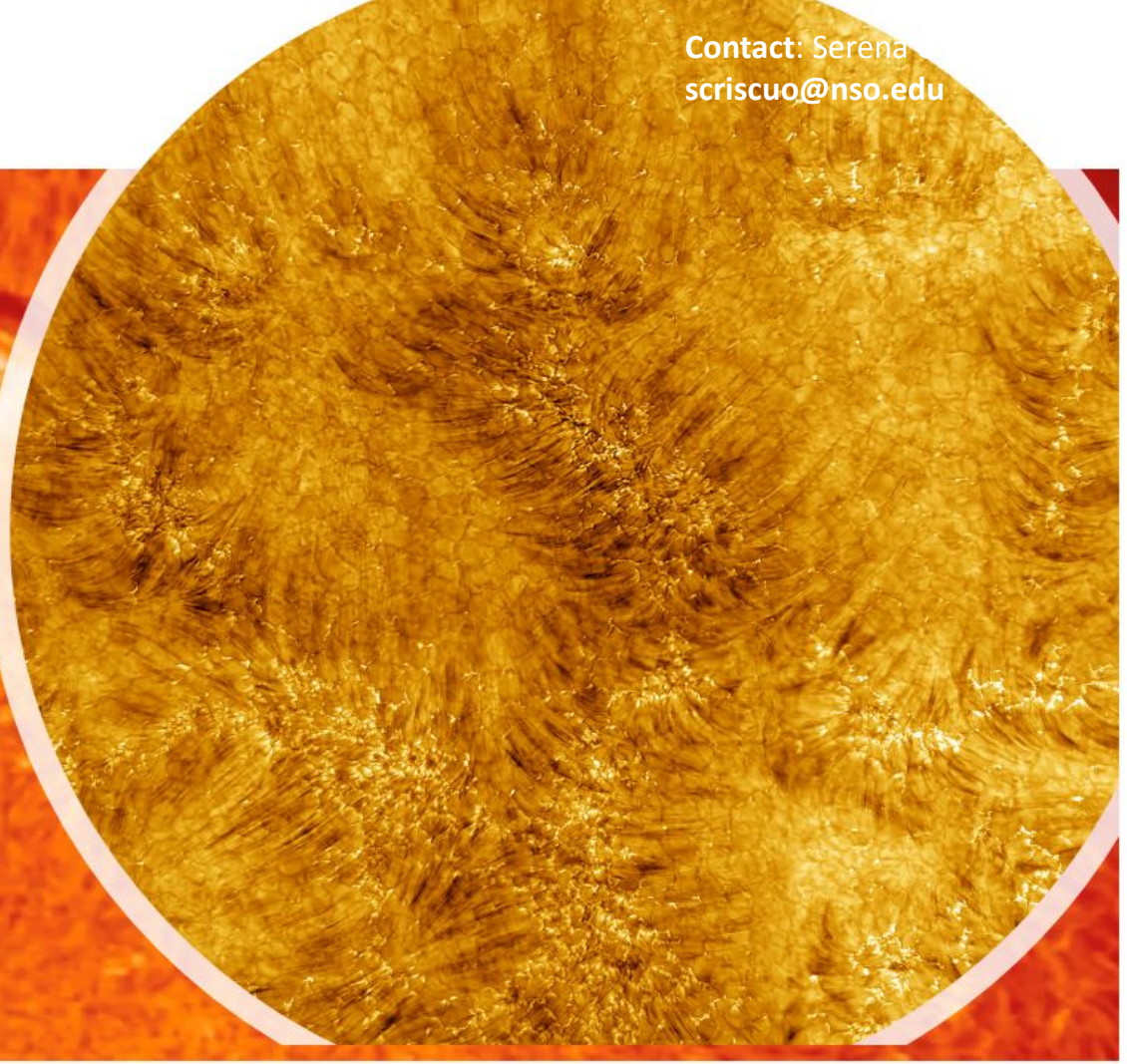
Requirements:

- ❑ Some Python/IDL experience
- ❑ Curiosity!

Desired:

- ❑ Observational Astronomy
- ❑ Spectroscopy

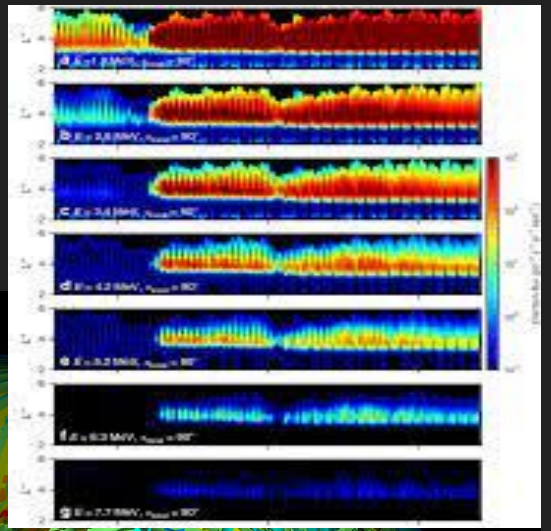
- ➢ Paid or independent study credit
- ➢ 10/15 hours per week
- ➢ Start: within ~3 months
- ➢ Time frame: 1 semester



Machine learning to predict killer electrons in space

Project Description:

In this project, we will develop a number of machine learning based models to study the space environment, including the killer electrons and electromagnetic waves in the Earth's radiation belt, the geomagnetic indices, and geomagnetically induced currents on the ground.



Skills Acquired:

- Comprehensive data analysis (Van Allen Probes)
- Experienced with Python projects
- Machine learning model development

Desired Applicant skills:

- Python coding (ASTR 2600 or equivalent)
- Clear written communication
- Excitement for Machine learning

Timeline and pay:

- Application open until Dec 22, 2023
- Paid position starting
- Spring 2024: 10-15 hrs per week
- Summer 2024: ~40 hrs per week

How to Apply:

- Email: xiangning.chu@lasp.colorado.edu
- CV, list of courses taken, a paragraph about your interest in the project.

https://doi.org/10.1029/2021SW002808

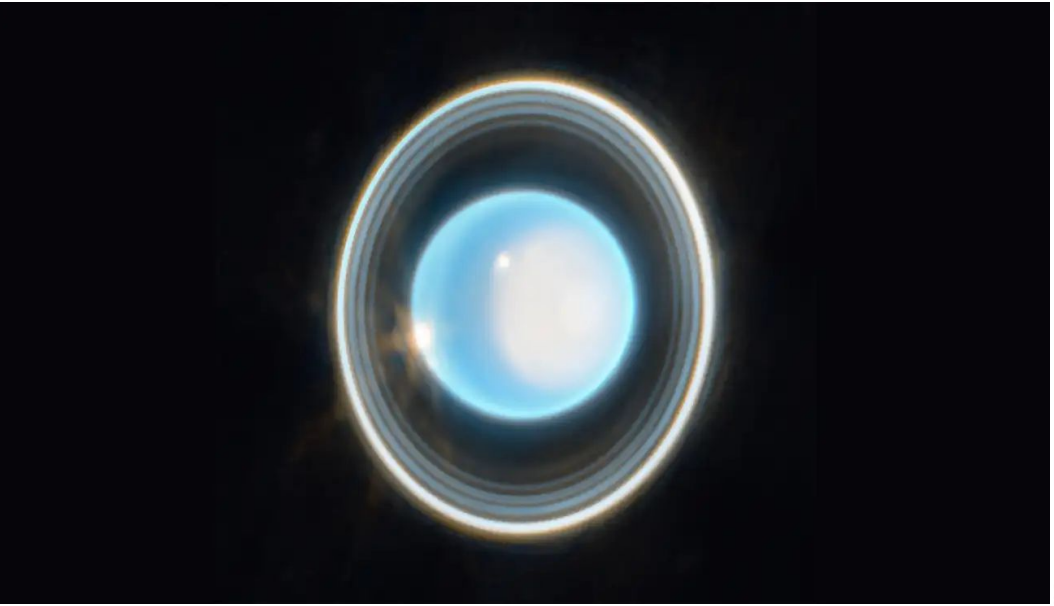
Statistics of Voyager Uranus and Neptune star occultations

Larry W Esposito

LASP & APS

Study Ring Occultations

- I am looking for a student who knows IDL or Python to analyze the statistics of Voyager Uranus and Neptune star occultations
- This method can find structures (like clumps or gaps in the rings) with 100 times better resolution than spacecraft cameras or with the James Webb telescope! Find *meter*-sized features
- Similar structures are seen in forming star systems, galaxies, accretion disks…
- Requires statistics & programming
- Options: Write a UROP proposal or do this as independent study
- Time commitment per week: 10 hours minimum, CU's maximum is 20
- Duration: One semester, may be extended
- To apply, send 1-page resume that highlights your interest and skills larry.esposito@lasp.colorado.edu before 15 December 2023



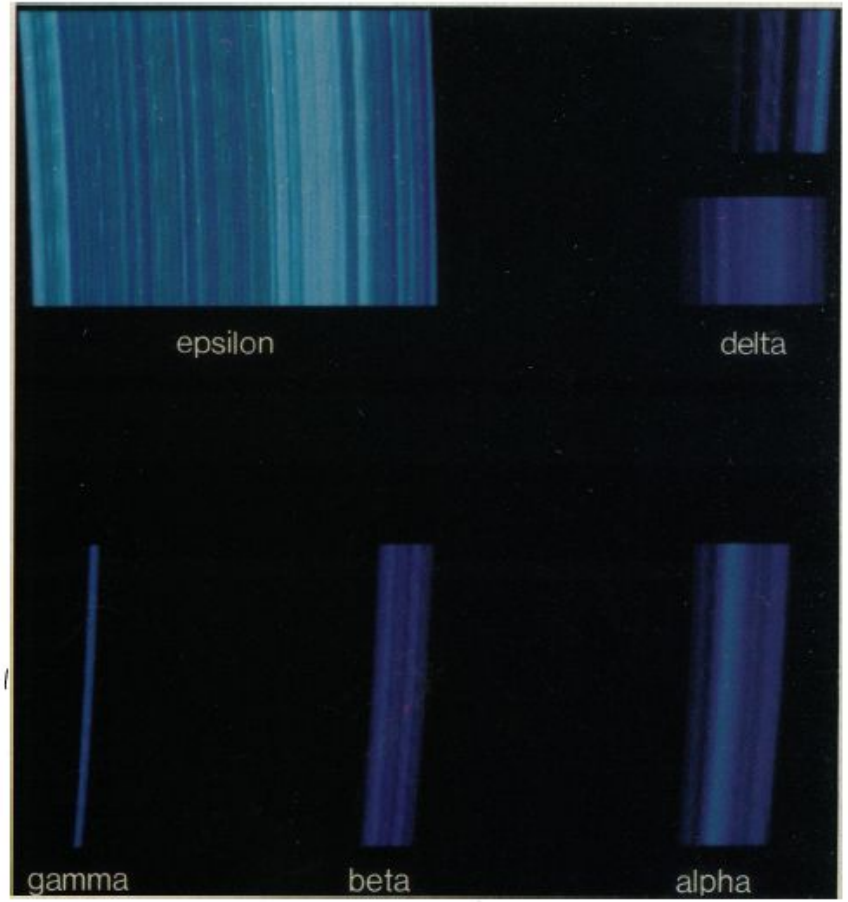


Fig. 5. The five most opaque rings of Uranus as seen by the Voyager PPS occultation. The data for the ε ring were smoothed to 100-m resolution. For the other rings, data were smoothed to 1-km resolution. This image was created from individual cuts across each of the rings on the assumption of azimuthal symmetry.

JWST image (above) of Uranus ring system from 2023.

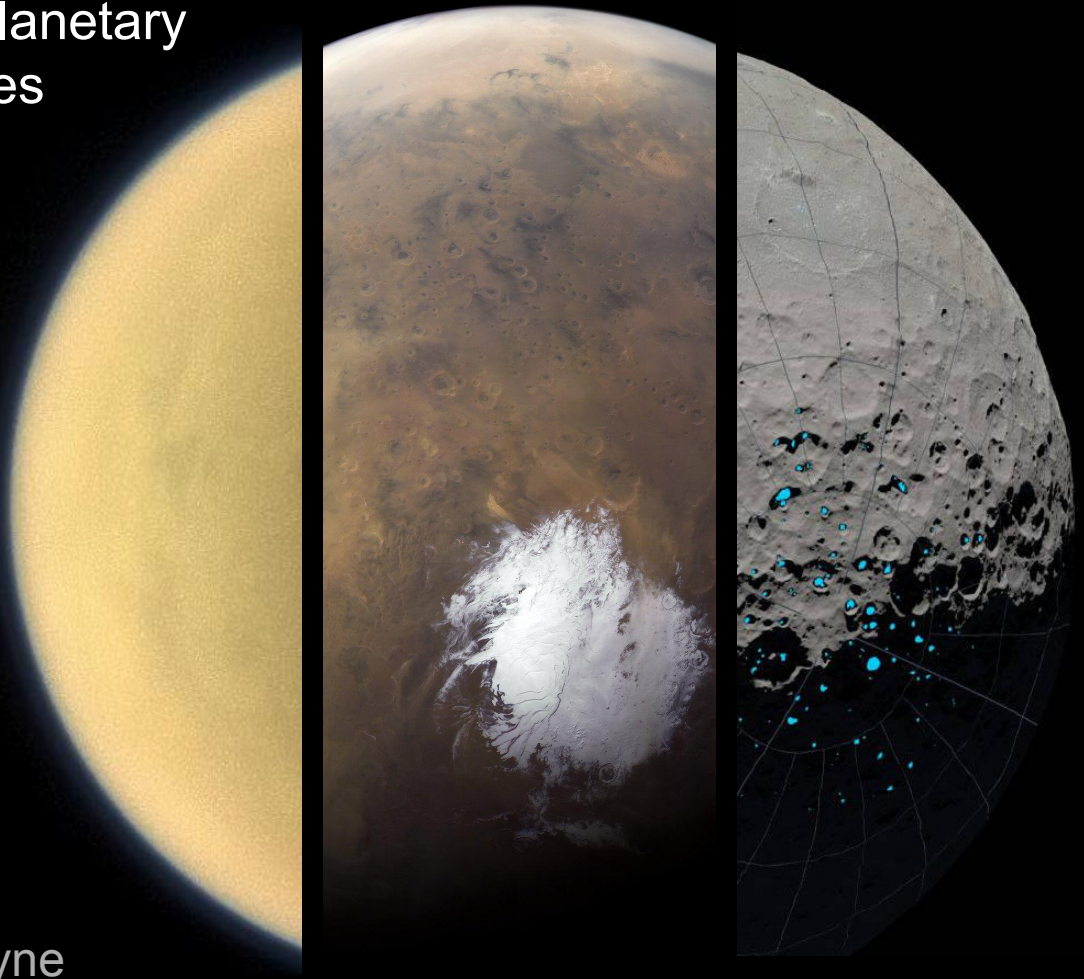
Voyager close-up (left) from 1986 has better resolution.

Statistical methods can detect structures 10x smaller!

Exploration of Planetary Ices and Climates

(EPIC @ LASP)

E P I C
Exploration of Planetary Ices and Climates



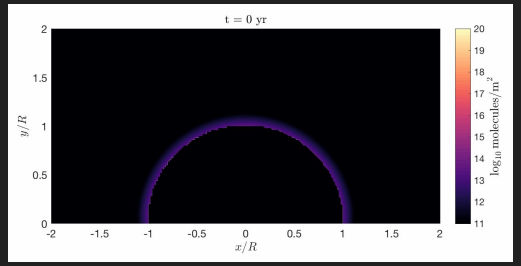
PI: Prof. Paul Hayne

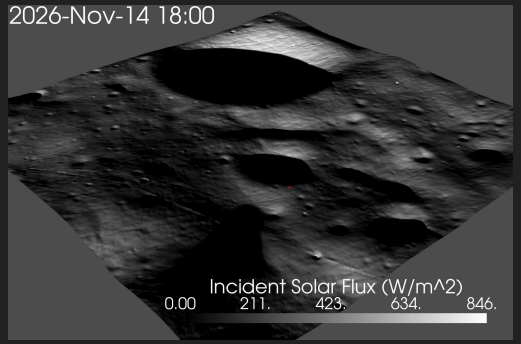
Exploration of Planetary Ices and Climates

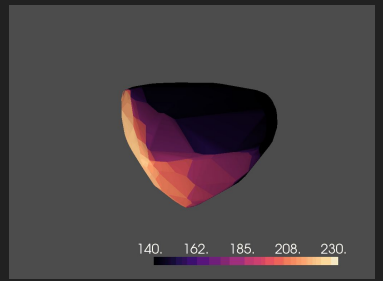
E P I C
Exploration of Planetary Ices and Climates

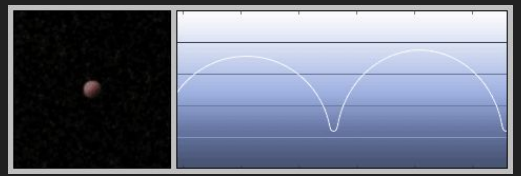
Possible research projects include:

- Modeling plume deposits on Europa and their observable signatures in thermal infrared data (Europa Clipper mission)
- Simulating views of the lunar surface in 3D (L-CIRiS/NASA CLPS/Artemis)
- Analyzing asteroid lightcurve data (Emirates Mission to the Asteroid belt)









Exploration of Planetary Ices and Climates

E P I C
Exploration of Planetary Ices and Climates

Possible research projects include:

- Modeling plume deposits on Europa and their observable signatures in thermal infrared data (Europa Clipper mission)
- Simulating views of the lunar surface in 3D (L-CIRiS/NASA CLPS/Artemis)
- Analyzing asteroid lightcurve data (Emirates Mission to the Asteroid belt)

Physics 2, Calc 2, ASTR 1030	Computer programming @ level of 2600	Computer programming @ level of 3800
✔	✔	
✔	✔	✔
✔	✔	

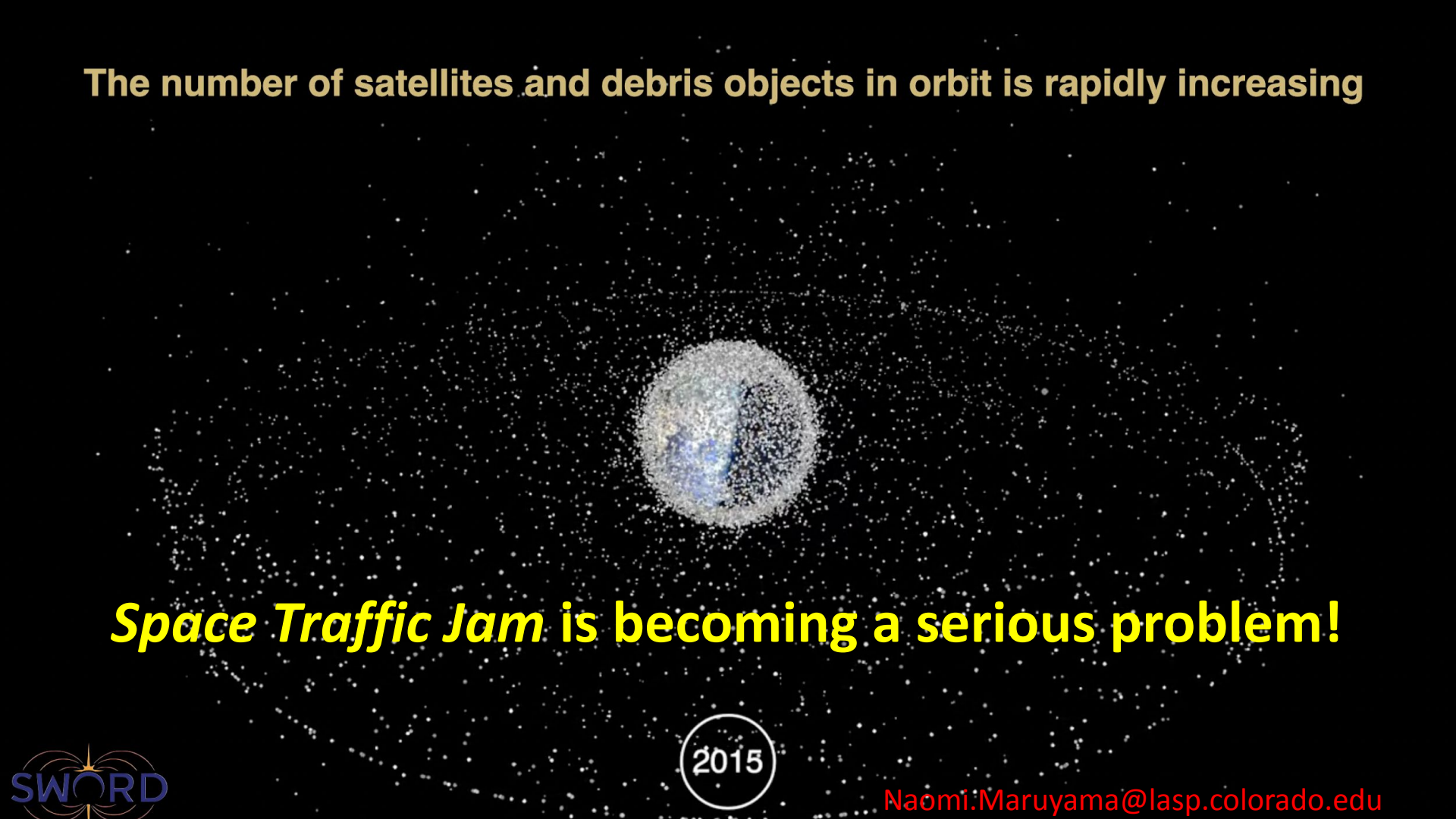
Exploration of Planetary Ices and Climates

Interested?

- ➔ Send a message to Paul.Hayne@Colorado.edu
- ➔ Include a CV/resume and an example of work you are proud of!
- ➔ Funding is available for full-time summer work
- ➔ I am open to UROP proposals for part-time work during spring semester

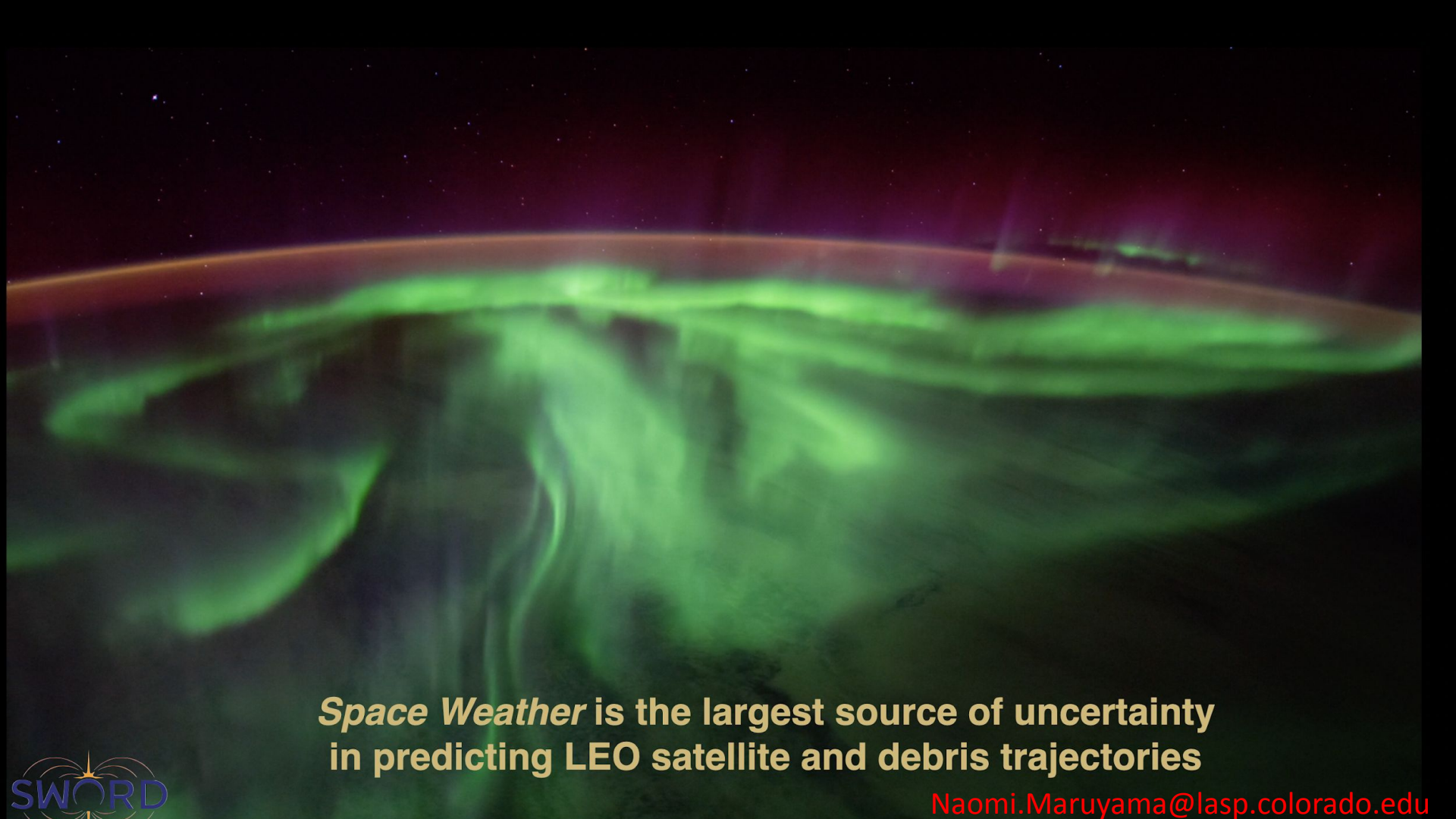
Laboratory for Atmospheric and Space Physics
University of Colorado Boulder

The number of satellites and debris objects in orbit is rapidly increasing



Space Traffic Jam **is becoming a serious problem!**

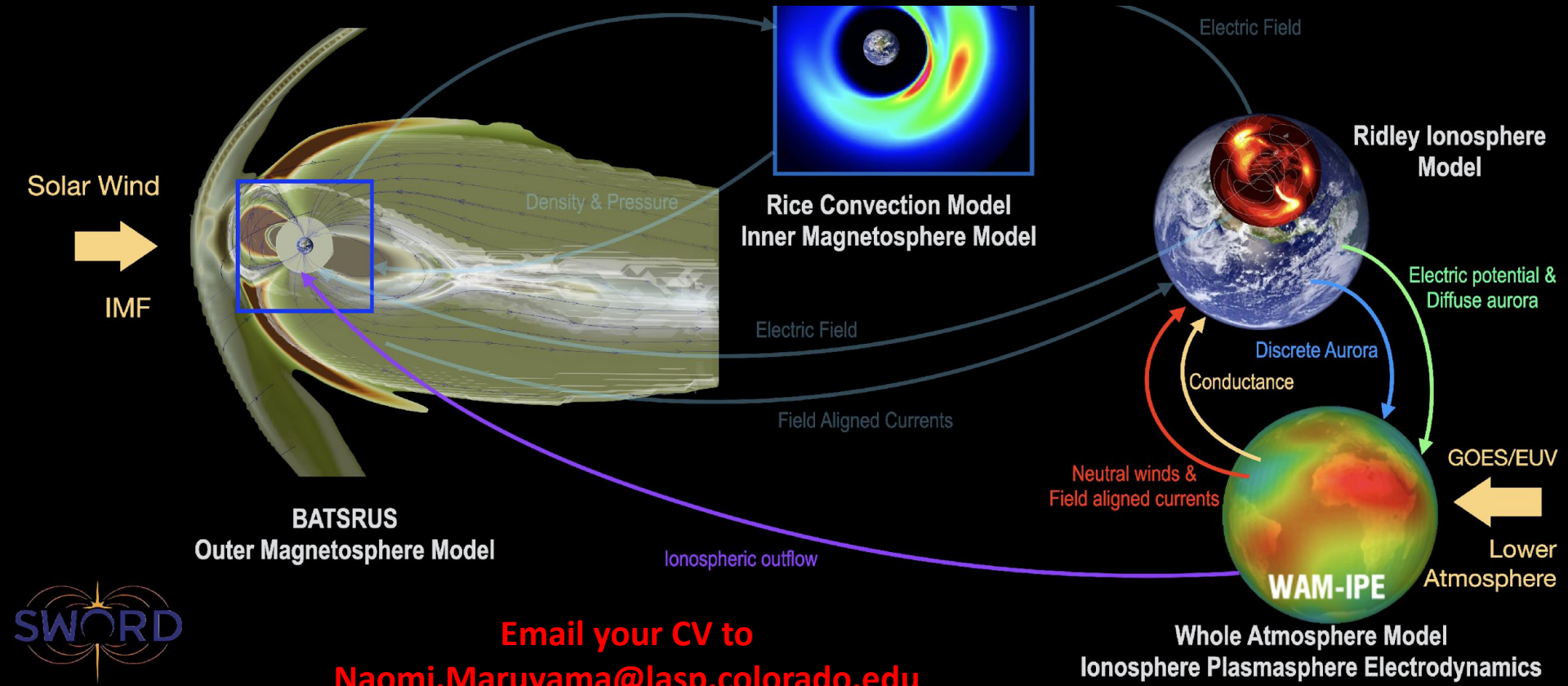
Naomi.Maruyama@lasp.colorado.edu



Space Weather **is the largest source of uncertainty in predicting LEO satellite and debris trajectories**

Naomi.Maruyama@lasp.colorado.edu

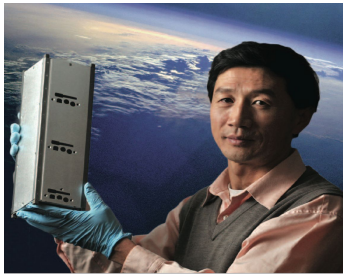
Your help needed to predict ***Space Traffic Jam*** with high performance computer simulations



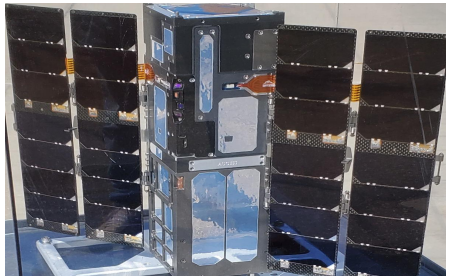
SWORD

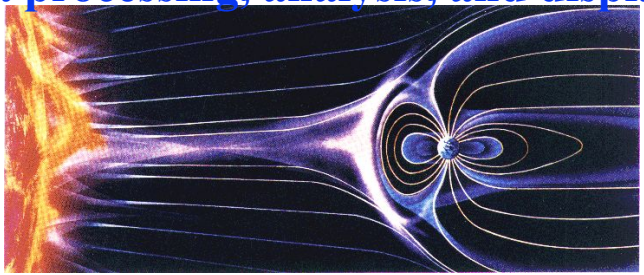
Email your CV to
Naomi.Maruyama@lasp.colorado.edu

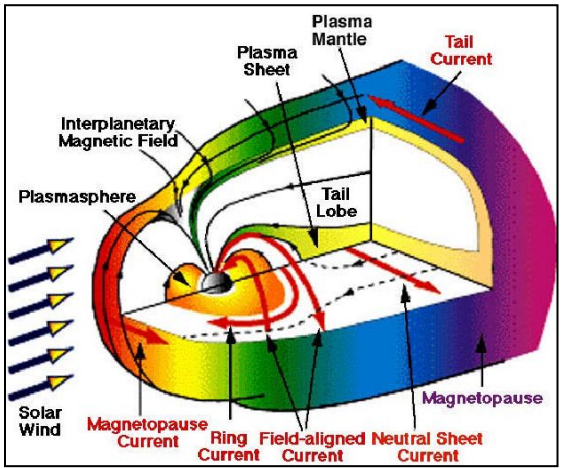
Prof. Xinlin Li's research: Sun-Earth connection, solar wind interaction with the Earth's magnetosphere, geomagnetic storms, energetic particle dynamics



PI on NASA funded ($4M) CubeSat: Inner Radiation Belt Experiment (CIRBE), launched on 15 April 2023.The only science payload, Relativistic Electron and Proton Telescope integrated little experiment – 2 (REPTile-2), has been collecting high quality data. Undergraduate Research Assistant(s) can be supported by this project for data processing, analysis, and displaying.

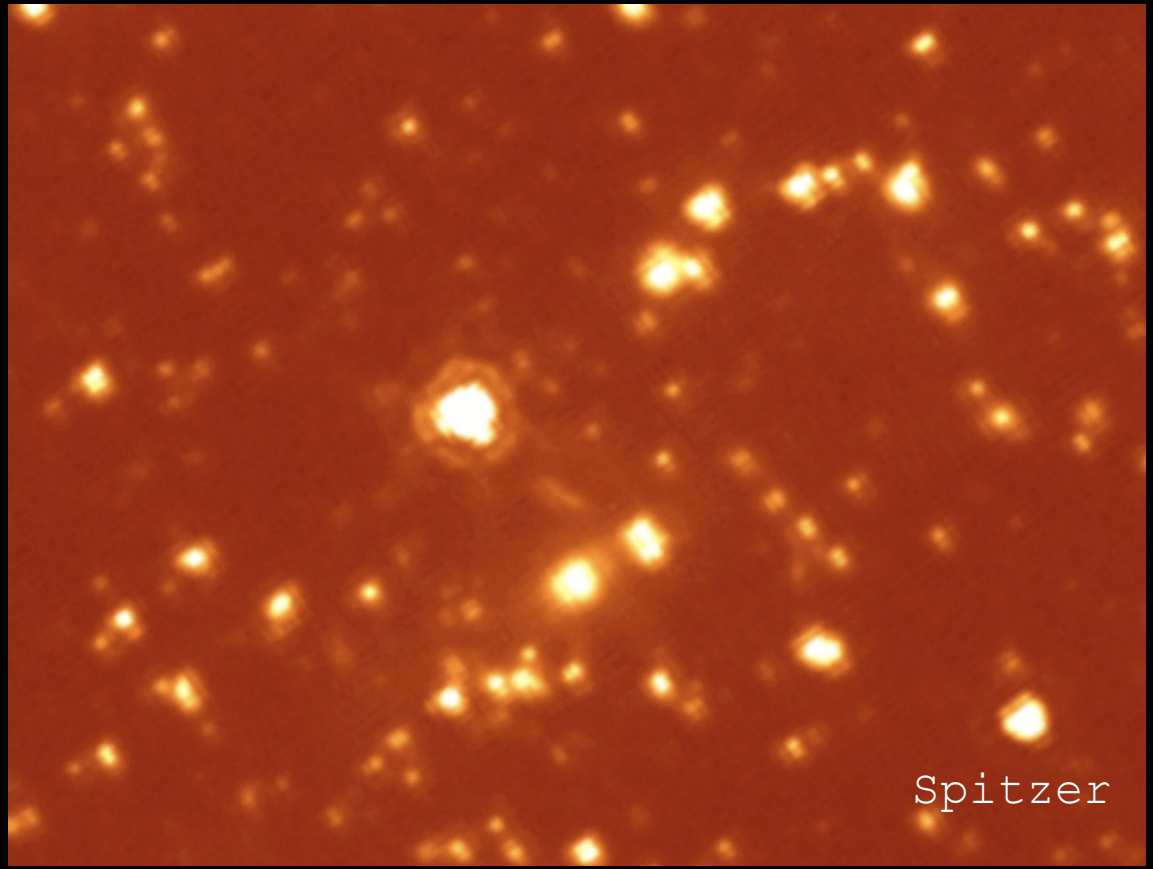






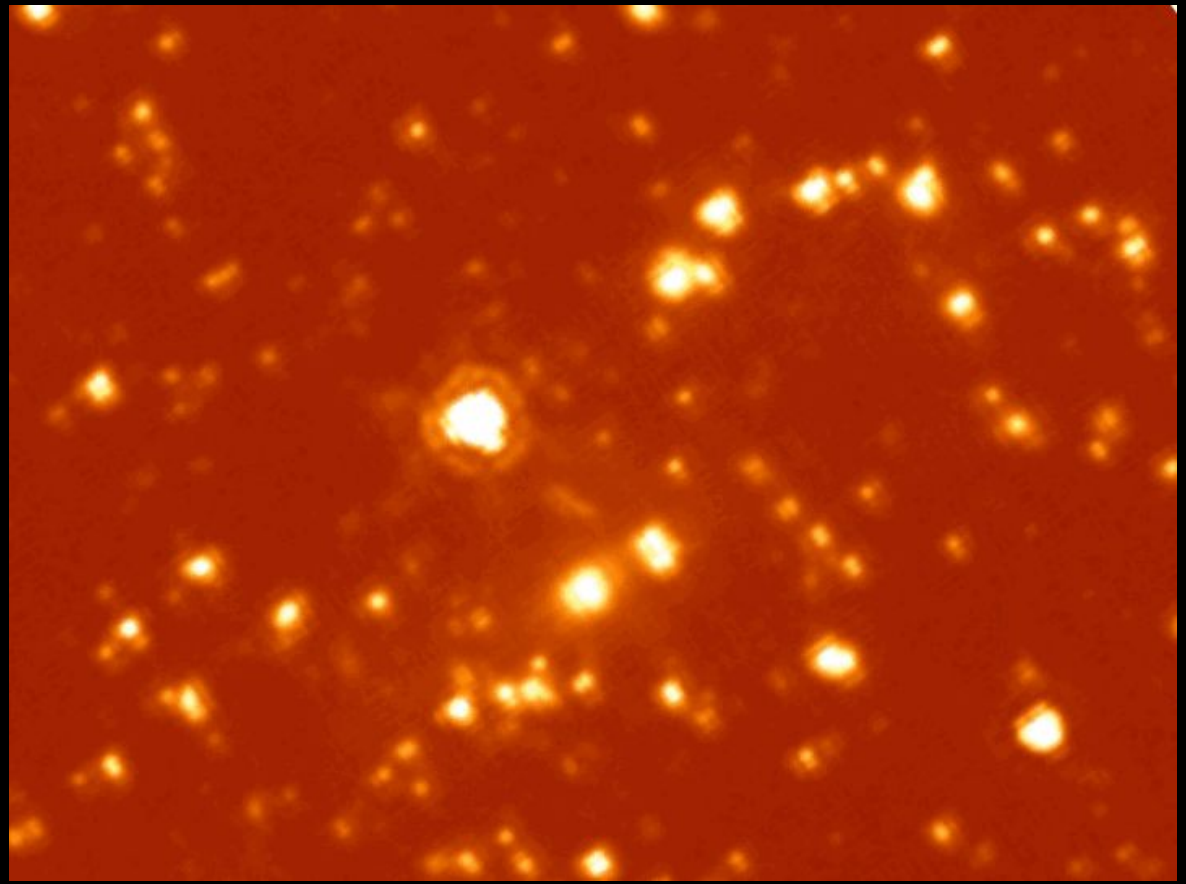
The solar wind controls magnetospheric dynamics, but the detailed physical processes are still not well understood.

Galaxies, dark matter, and the early universe with JWST



Prof Erica Nelson & Abby Hartley

Galaxies, dark matter, and the early universe with JWST



Prof Erica Nelson & Abby Hartley

Job Description

Galaxies, dark matter, and the early universe with JWST w/Prof Erica Nelson

Project:
- Conduct research on galaxy formation using new data from the James Webb Space Telescope.
- Use a new data analysis method to understand the motion of gas within galaxies with the goal of placing novel constraints on the distribution of dark matter at early cosmic times.

Skills learned on the job:
- Analysis of JWST data
- The physics of galaxy formation
- Scientific writing

Qualifications:
- Ability to program in Python (i.e. ASTR 2600 or equivalent competency)
- Broad strokes understanding of galaxies and galaxy dynamics (e.g. ASTR 1040).

Research group:
- CU Extragalactic group — Faculty (Erica Nelson), postdocs, grad students, undergrads (incl. Abby Hartley)

Job:
- Primary work: Summer 2024, >20 hours / week, paid

How to apply:
- Email Erica.June.Nelson@colorado.edu:
  - Resume
  - 2 Paragraph cover letter describing why you are interested in this position and your plans / goals after undergraduate
-

Closing Comments

- Whether it's REU's or faculty-sponsored project's, apply to lots (10 or more). Scientists are interest in everything.
- Many projects have 15 December deadlines and hope to start projects in January
- Opportunities are posted through the year, and you can make your own opportunity by talking to faculty & researchers
- Projects may last a semester and give you a great experience (and recommendation letter), or continue and expand through graduation into a career

This concludes our events for the semester
Have a great break and we'll see you in 2024!!

Spring Semester:

TBD: Careers in Telescopes and Observing

TBD: Careers in Education and Outreach

TBD: Careers in Industry, Aerospace

TBD: Careers in Startups

TBD: Applying for Jobs