



National Academies Board on Physics and Astronomy – May 7
Roundtable Discussion with NSF Directorates' Leadershi

Updates from NSF/GEO/AGS

Dr. Mangala Sharma (msharma@nsf.gov)

Geospace Cluster Coordinator & Program Director, Space
Division of Atmospheric and Geospace Sciences
NSF Directorate for Geosciences

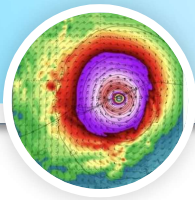
GEO in NSF

The Director, Office of Budget, Office of International
Engineering, Finance, & Award Management

Directorate for
Biological Sciences (BIO)



**Earth Sciences
(EAR)**



**Atmospheric and
Geospace Sciences
(AGS)**

Directorate for
**Geosciences
(GEO)**



**Ocean Sciences
(OCE)**



**Polar Programs
(OPP)**



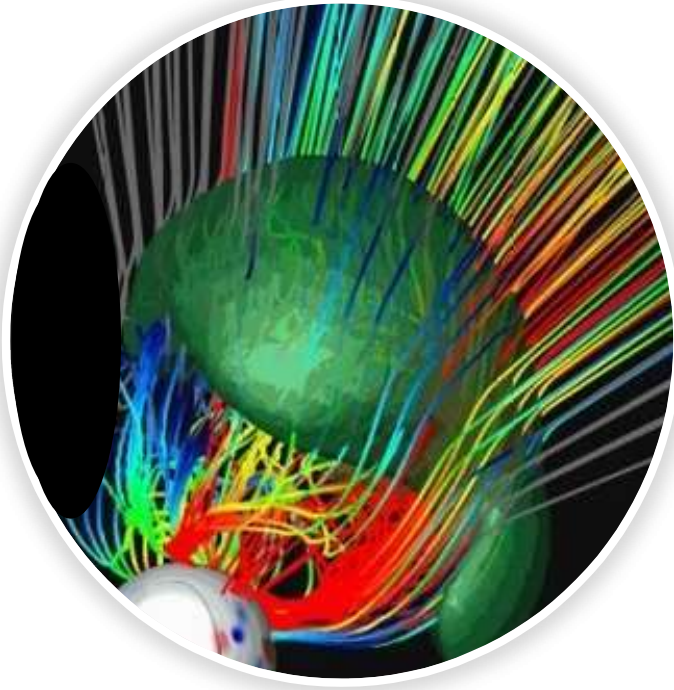
**Research, Innovation,
Synergies, and Education (RISE)**

Directorate for
Engineering (ENG)

for
toral &
ces (SBE)

Direct
**Technology,
Partners**

D
STP



Research



Research
Infrastructure



Workforce
Development

Build a Resilient Planet Initiative



**Response of
Earth's systems
to changing
climate**



**Adaptation
and resilience**



**Clean energy
technologies**



**Nature-based
solutions**



**G
me
ar**



Build A Resilient Planet Initiative

DCL: Build a Resilient Planet: <https://www.nsf.gov/pubs/2024/nsf24022/nsf24022>

Confronting Hazards, Impacts and Risks for a Resilient Planet program:

<https://new.nsf.gov/funding/opportunities/confronting-hazards-impacts-risks-resilient-p>



Planning
Proposals



Conference
Proposals



EARly-concept
Grants for
Exploratory
Research (EAGER)



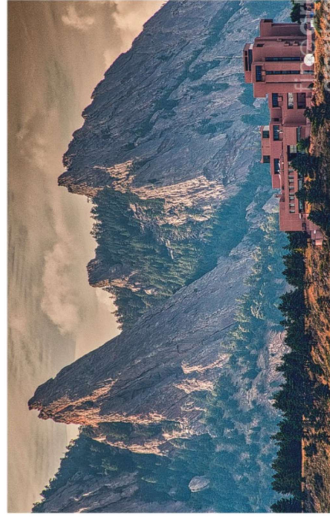
Research
Advanced by
Interdisciplinary
Science and
Engineering
(RAISE)



Research
Coordination
Network (RCN)



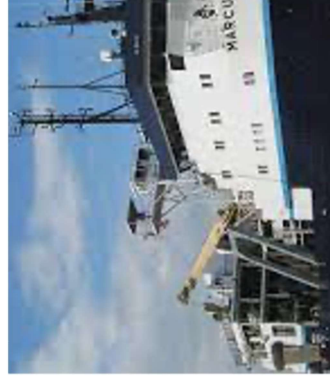
GEO Facilities



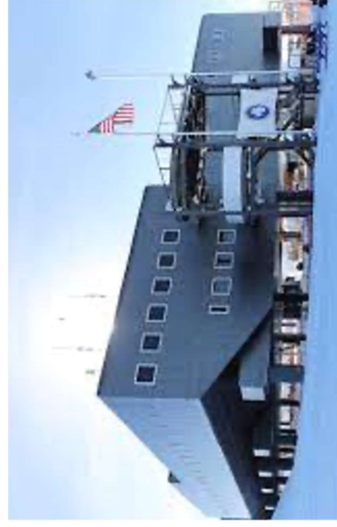
NCAR



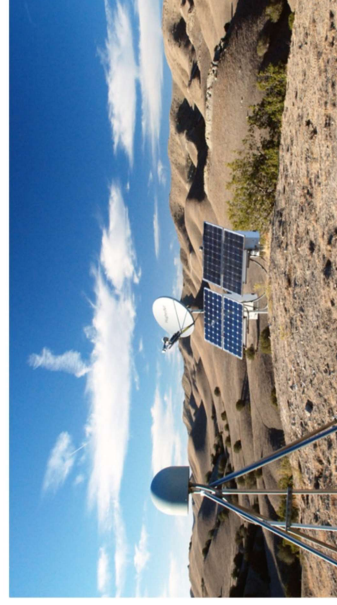
Seismic and Geodetic



Research V



Polar Facilities



Ocean Observatories



Repository

GEO EMpowering BRoader Academic Capacity and Education (EMBACE) Solicitation

- Support research and educational efforts at "non-R1" institutions, including minority serving institutions, two-year colleges, primarily undergraduate institutions
- Mitigate multiple barriers faced by faculty members in geosciences and related fields at non-R1 institutions in submitting and obtaining federal funding
- **Seed proposals** - up to two years of funding to (1) initiate research and/or education programs at their own institutions; and/or (2) build or catalyze research collaborations or partnerships
- **Growth proposals** up to four years of funding to establish independent GEO-related disciplinary research programs
- Award recommendations in progress

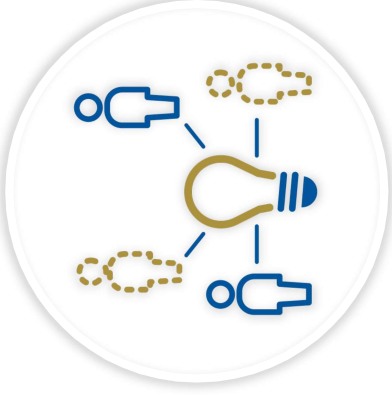


Focus On Recruiting Emerging Climate and Adaptation Scientists and Transformers

GOAL: Facilitate transition from undergraduate to graduate programs in STEM fields through student-centered preparation and capacity building



Innovation



Entrepreneurship



Community-Focused
Resilience Science



<https://new.nsf.gov/funding/opportunities/focus-recruiting-emerging-climate-adaptation>

Division of Atmospheric and Geospace Sciences

Infrastructure

Cluster

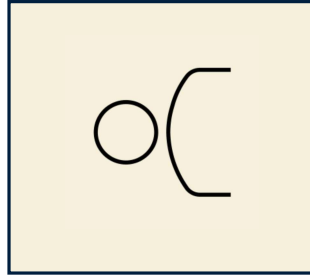
NSF NCAR, Geospace
Facilities, etc.

Geospace Cluster

Atmosphere Cluster



Anne Johansen
Division Director



David Verardo
Acting
Deputy Division Director



Mangala Sharma
Space Weather
&
Geospace Cluster
Coordinator

TBD
Program Director



Chia-Lin Huang
Magnetospheric
Physics



Shikha Raizada
Aeronomy

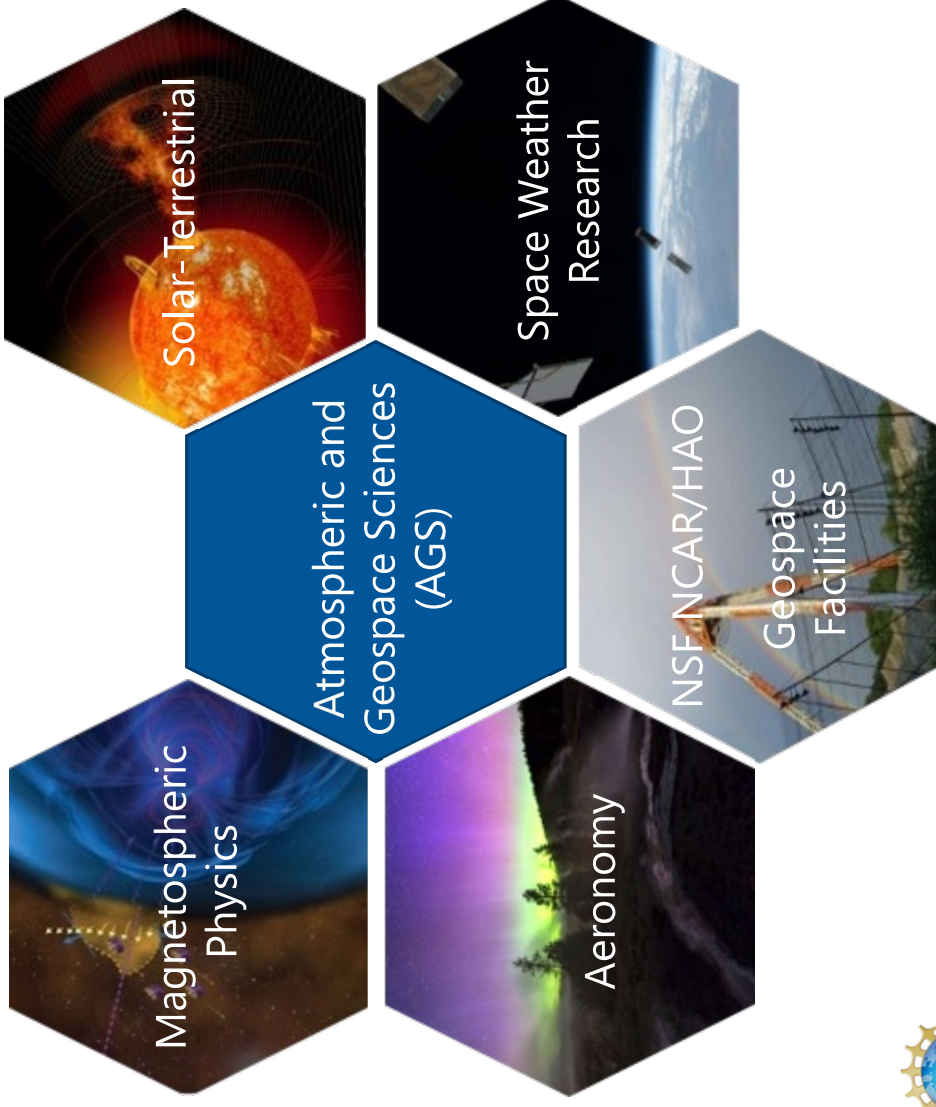


Tai-Yin Hsu
Data Infrast



Lisa V. Thompson
Solar-Terrestrial
(Detail to NASA)

NSF Geospace Focus Areas



Solicitation

NSF 22-575: Coupling, Energetics, and Dynamics of Atmospheric Regions

NSF 22-537: Geospace Environment Modeling

NSF 22-570: Solar, Heliospheric, and Interplanetary Environment

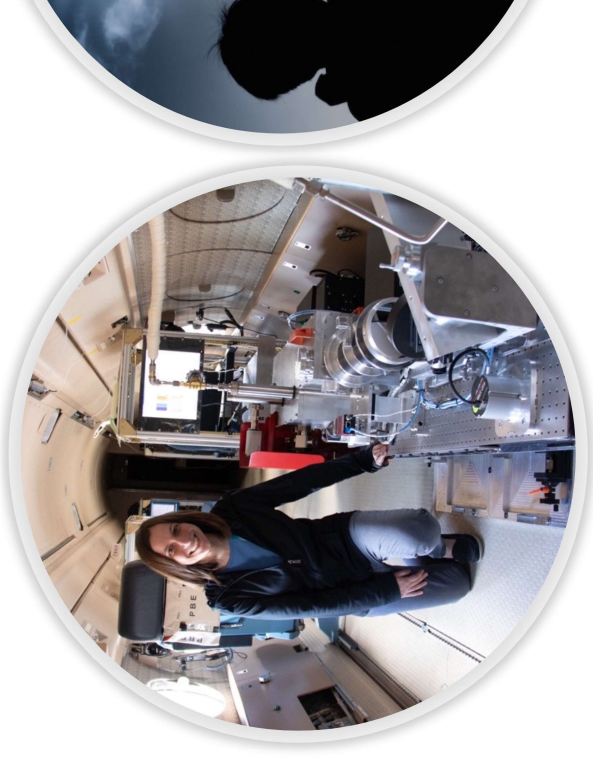
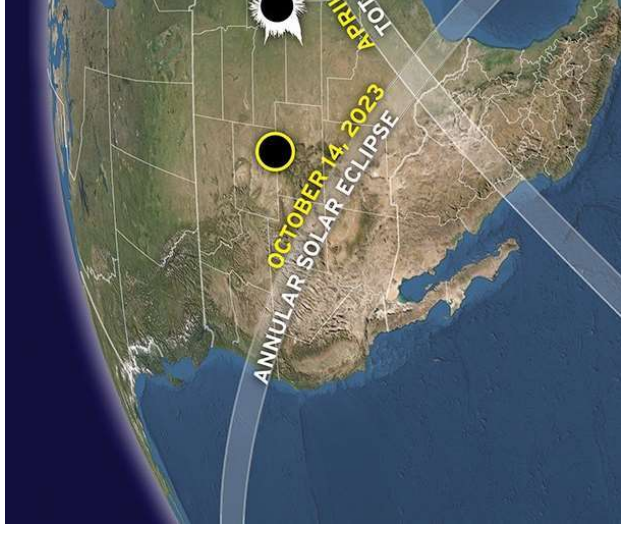


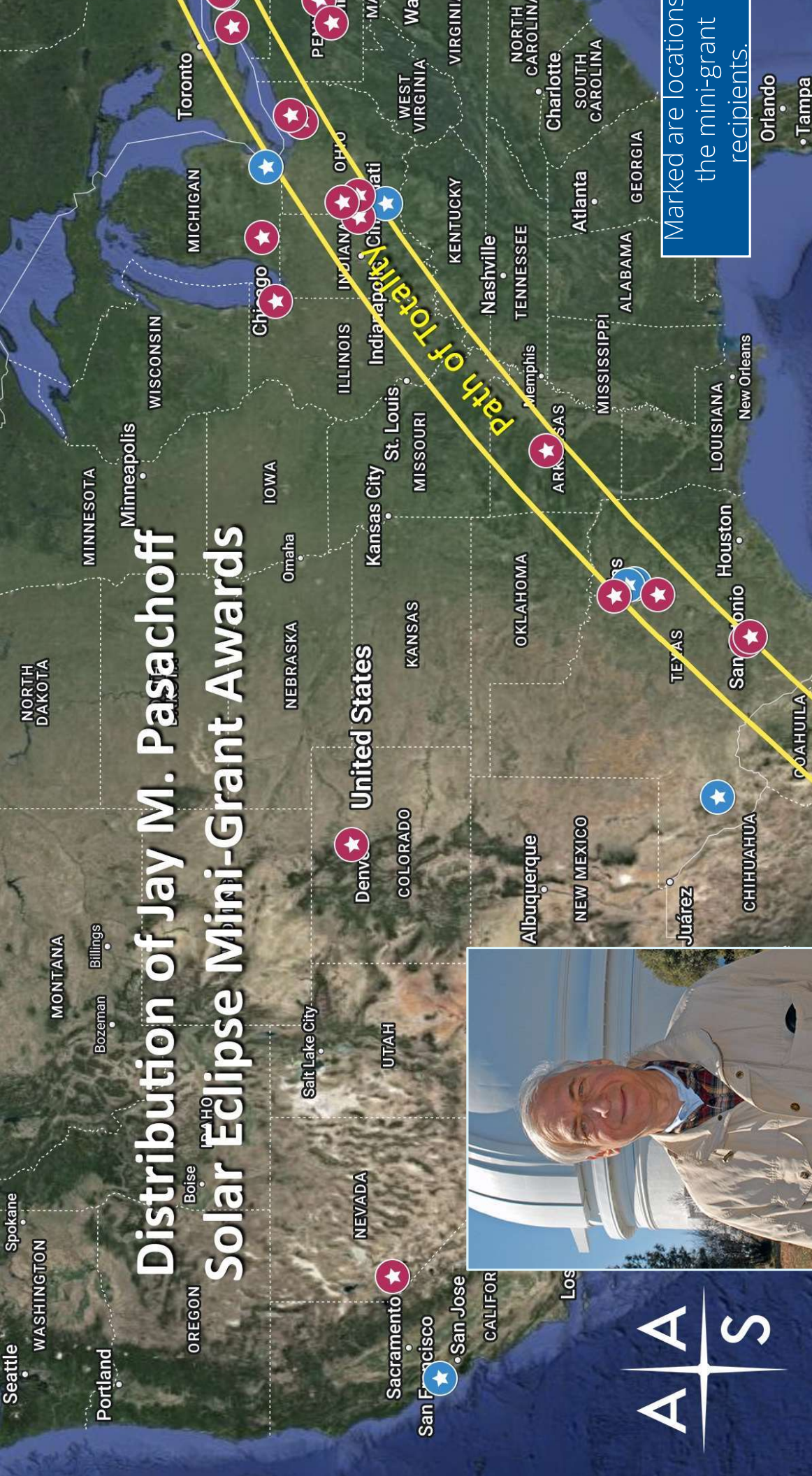
NSF 23-014 DCL: Great American Solar Eclipses of 2023 and 2024

Awards and supplemental funding from GEO/AGS and MPS/AST for science and outreach around the 2023 and 2024 solar eclipses.

Several proposals funded in Geospace programs that promote:

- **Outreach Activities** (HamSCI, Univ. of Texas at Arlington, Big Bear Solar observatory)
- **New observations using existing facilities and instruments during eclipse** (Magnetometers, Millstone Hill ISR, Dynosondes, Radiometers etc)



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Distribution of Jay M. Pasachoff Solar Eclipse Mini-Grant Awards

Path of Totality

Marked are locations the mini-grant recipients.

United States

Albuquerque

NEW MEXICO

CHIHUAHUA

Juarez

San Antonio

Houston

New Orleans

LOUISIANA

MISSISSIPPI

ARKANSAS

Memphis

TENNESSEE

Nashville

KENTUCKY

INDIANA

OHIO

Illinois

St. Louis

MISSOURI

Kansas City

KANSAS

Omaha

IOWA

MINNESOTA

MINNESOTA

Chicago

WISCONSIN

Toronto

PEPPER

WEST VIRGINIA

VIRGINIA

NORTH CAROLINA

Charlotte

SOUTH CAROLINA

Georgia

Atlanta

Orlando

Tampa

San Francisco

San Jose

CALIFORNIA

Sacramento

NEVADA

Salt Lake City

UTAH

Boise

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Bozeman

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Spokane

WASHINGTON

Portland

Seattle

Los Angeles

AS

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Idaho

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Space Weather Characterization and Modeling

Over \$600M in NSF funding since 2009 for SWx research and infrastructure

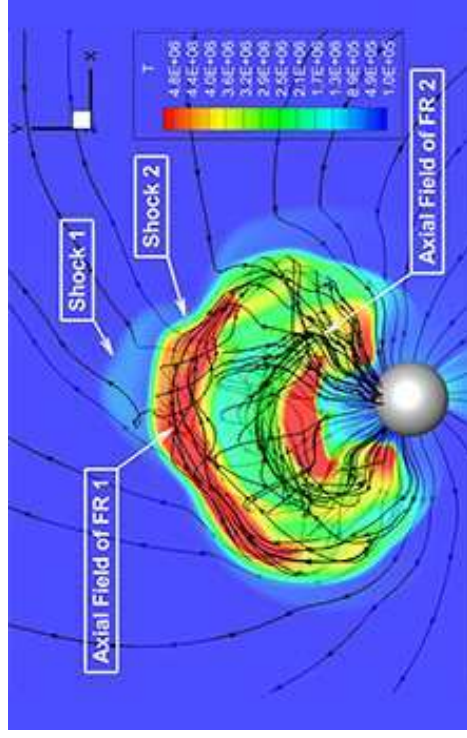
Deep and transformative understanding of the dynamic, integrated Sun-Earth system and the solar and terrestrial drivers of space weather and their effects “from Sun to mud”

Advancing National Space Weather Expertise
Research toward Societal Resilience (ANSWER)

- Modeling solar energetic particles to terrestrial drivers
- NSF support for 7 projects, FY22-26 \$11.8M

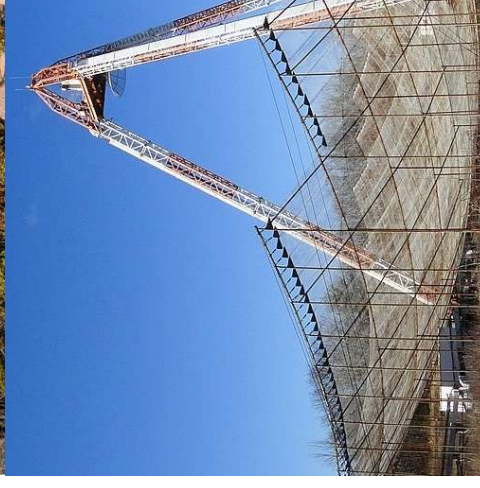
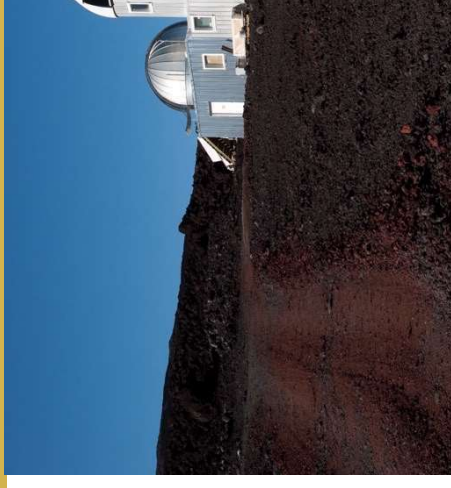
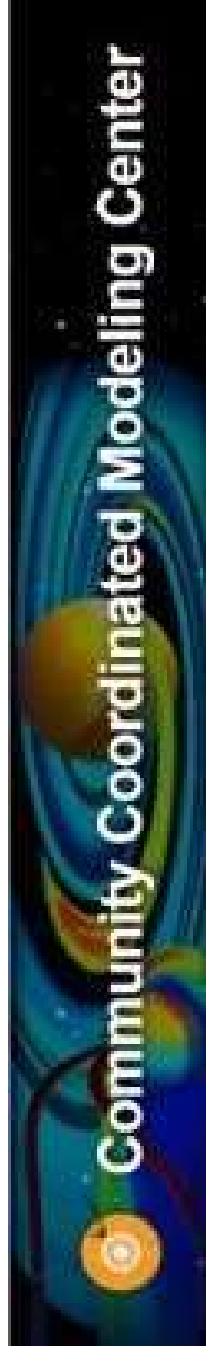
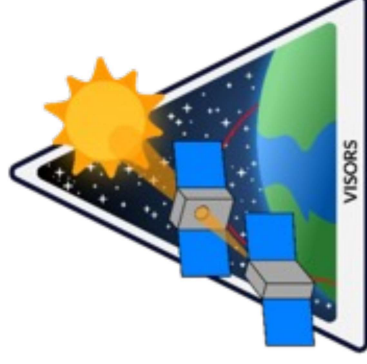
Space Weather with Quantified Uncertainties

- Applying advances in computer modeling and data techniques to SWx modeling and prediction
- NSF and NASA support for 6 projects, FY20-24, \$11.8M



Geospace Research Infrastructure

- Ground-based facilities
- Cubesats and airborne instruments
- Modeling centers, high-performance computing resources, and data repositories



Ionosphere-Thermosphere Observations

Millstone Hill Observatory



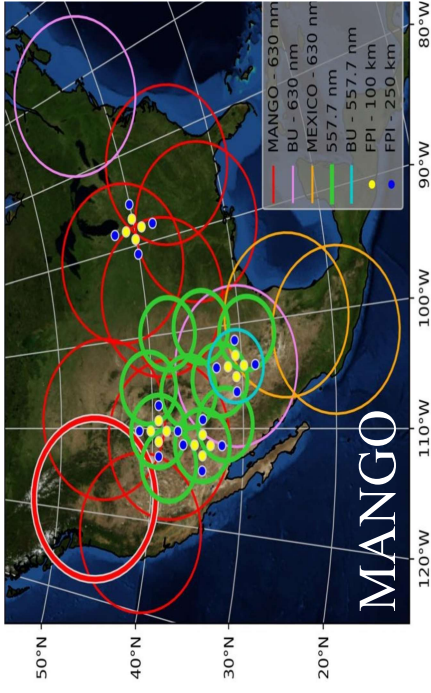
Jicamarca Radio Observatory



Poker Flat ISR



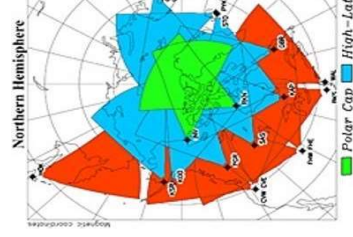
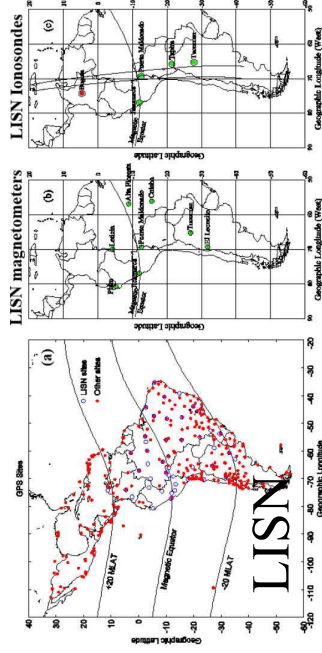
Resolute Bay ISR



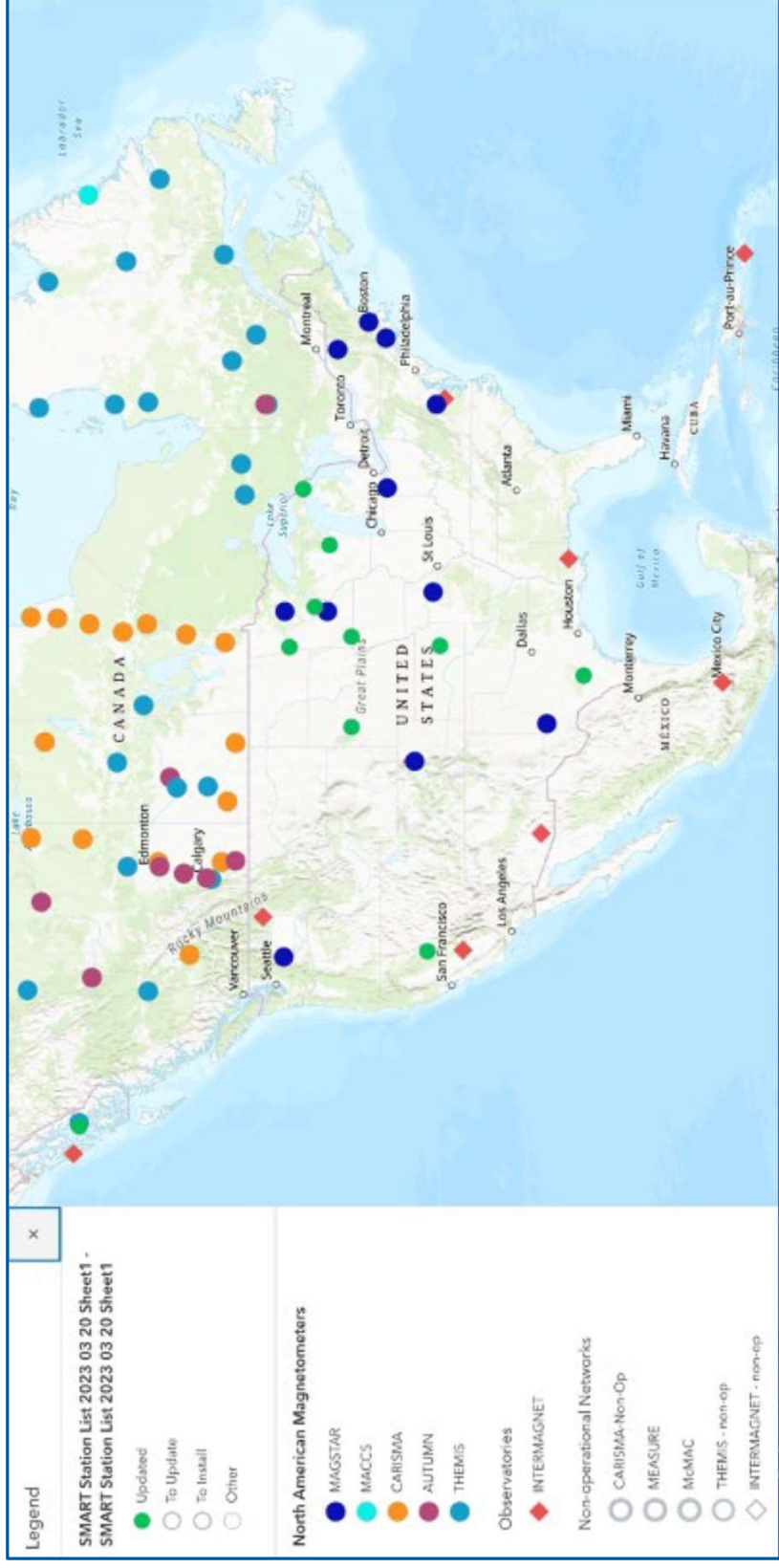
Subauroral Geomagnetic



Sup

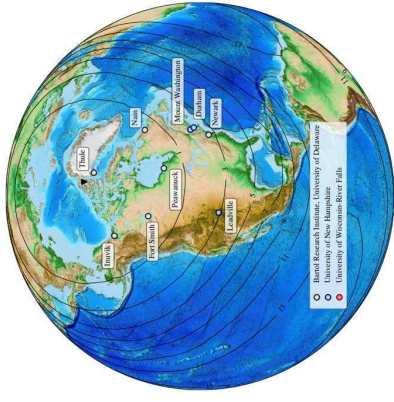


Magnetic Field Measurements

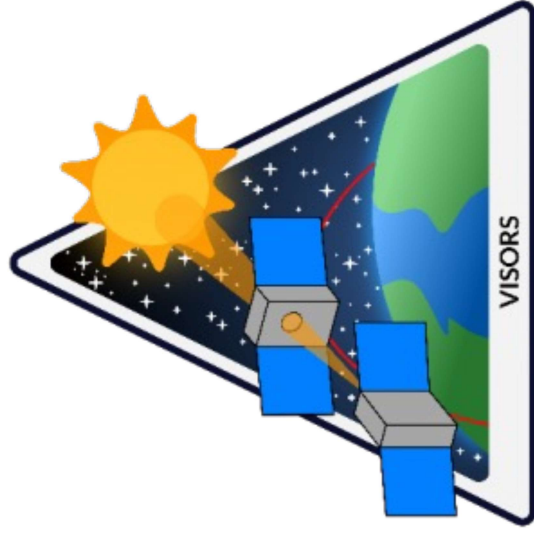


Ground-based Magnetometer Networks

Solar Observations



Simpson Neutron



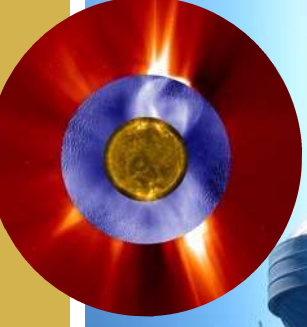
Impulsive Phase Rapid Energetic Solar Spectrometer

NCAR's Solar- Terrestrial Lab

- Enabling world-class science
- Serving observations & modeling to the community
- Building innovative instrumentation



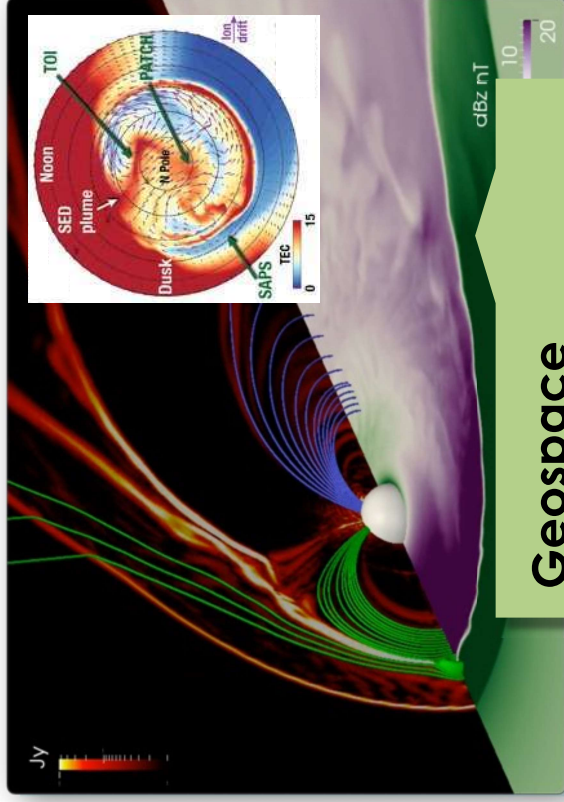
**Mauna Loa Solar
Observatory**



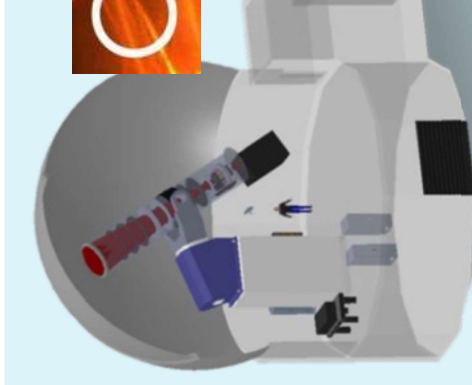
First HAO/ASP/NSO School
SOLAR SPECTROSCOPY
and Diagnostic Techn



**Building our
capabilities**



**Geospace
Modeling**



**CORONAL SOLAR
MAGNETISM**



NSF 24-538 Distributed Array of Small Instr

Goal: Supports the development, deployment and operation of instruments distributed arrays to conduct high spatial and temporal resolution measurements of solar and space physics research

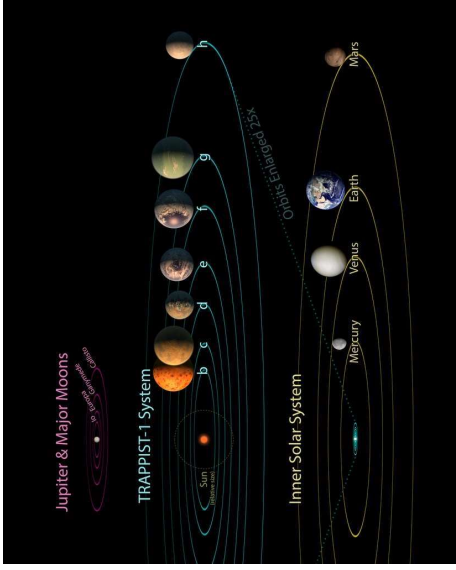
Full proposal deadline: May 15, 2024

Virtual office hour: Wednesday, March 27, 2024, 1-2pm EDT

Registration required:

<https://nsf.zoomgov.com/meeting/register/vJltcO2sqjkjGMvwXboet3wX-NOq>

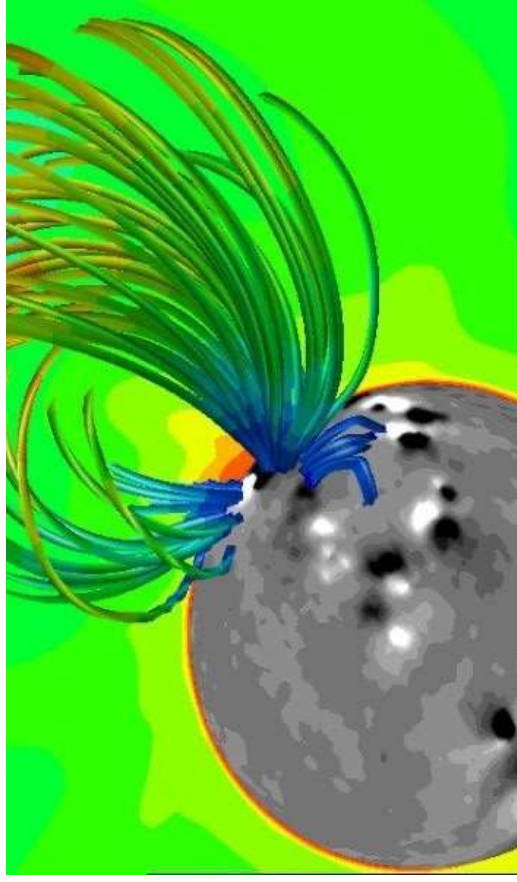
Cross-Directorate Programs & Solicitations



TRAPPIST-1 cf. solar system; credit NASA/JPL-Caltech/R. Hurt, T. Pyle (IPAC)

Geoscience Lessons for and from Other Worlds (GLOW)

DCL to study other worlds as a way to broaden our understanding of the Earth and its evolution, or use knowledge to understand the environments of other worlds



Space weather modeling framework simulation of the 9/10/2014 coronal mass ejection. Credit: Gabor Toth.

Ecosystem for Leading Innovation in Plasma Science and Engineering (ECLIPSE) NSF program to bring fundamental science to bear on problems of societal and technological importance

Geospace related examples:

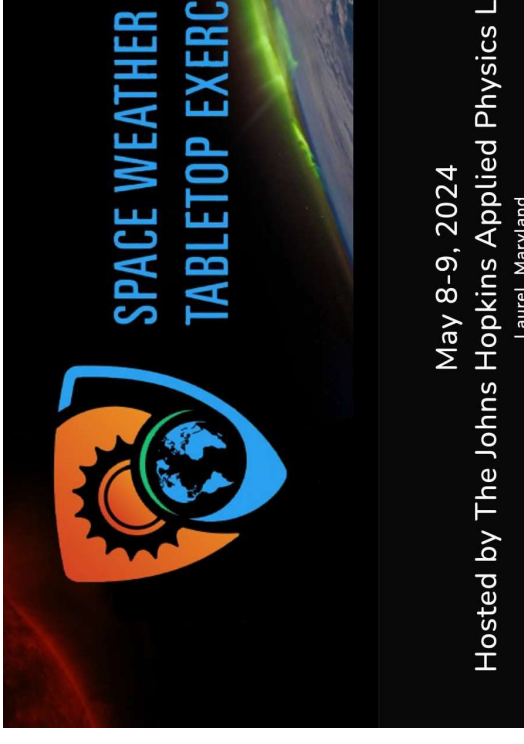
- Development of new computational methods for space weather prediction
- Sensor development for cubesat-based geospace measurements

Interagency Partnerships through SWORM and

- NOAA, NASA, NSF, DAF research-and-operations MOA, signed mid-2023; ceremonial signing December 7, 2023
- Includes space weather models, techniques, and technologies (Objective 2)



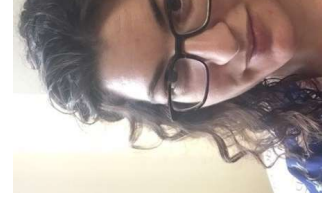
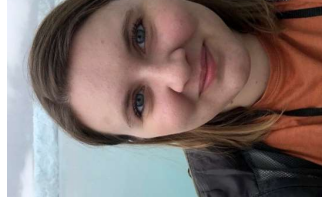
- NOAA, NASA, NSF, DHS/FEMA participation on SWx table top exercise, May 2024
- Focus: resilience to SWx hazards
- NSF interest: R&D gaps



Support for Early-Career Research

- **Undergraduate Students:** REU programs and GEOPATHS
- **Graduate Students:** NSF GRFP (due in Fall)
- **Postdoctoral Fellows:** AGS PRF
 - Within 2 years of PhD
 - Choose US host institution and mentor
 - ~ \$100k stipend/year for two years
 - No deadline, apply anytime!

**Recent PRFs in Solar Physics: Jimmy Juno,
Rachael Filwett, Ben Boe, Emily Lichko,
Sarah Conley**



Faculty Early Career Development 2023 A

- Securing the Future of Electric Field Measurements in Space Physics - **Katherine Goodrich** (WVU)
- Observational and Modeling Investigations of Pulsating Aurora Electrodynamics - **Stephen Kaeppler** (Clemson U.)
- Understanding Radiation Belt Electron Fast, Deep Injections in the Magnetosphere - **Hong Zhao** (Auburn U.)
- Understanding Collisionless Magnetic Reconnection as a Fundamental Heliospheric Process - **Colby Haggerty** (U. Hawaii)
- Evolution of Stream Interaction Regions from 1 to 5.4 AU and the Implications for Geomagnetically Induced Currents - **Rachael Filwood** (Montana State U.)

Faculty Development in geospace Science (FDSS)

Goal: Integrate topics in geospace science into natural sciences or related departments at U.S. institutions

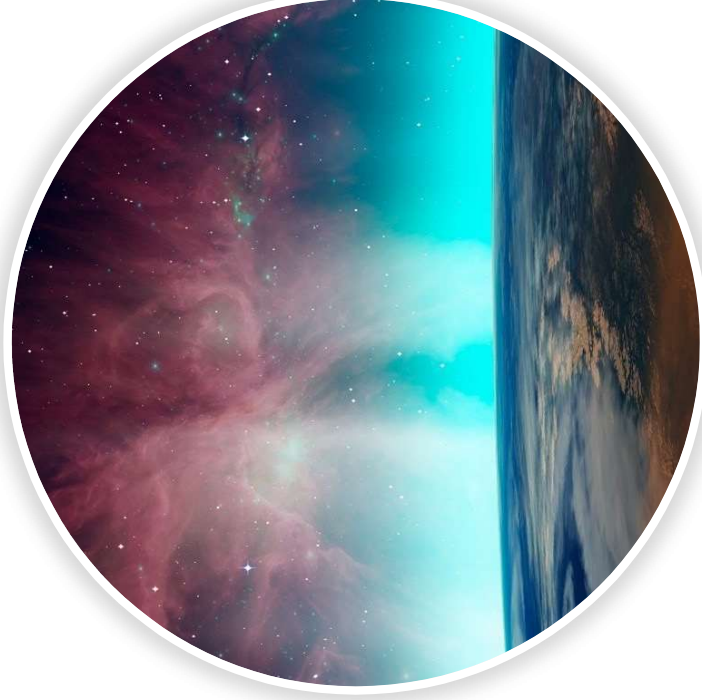
- Salary, benefits, and training for newly recruited tenure-track FDSS faculty; up to five years and \$1,500,000 total
- ***Track to support minority-serving institutions and emerging research institutions***
- Award recommendations for 2023 FDSS proposals in progress



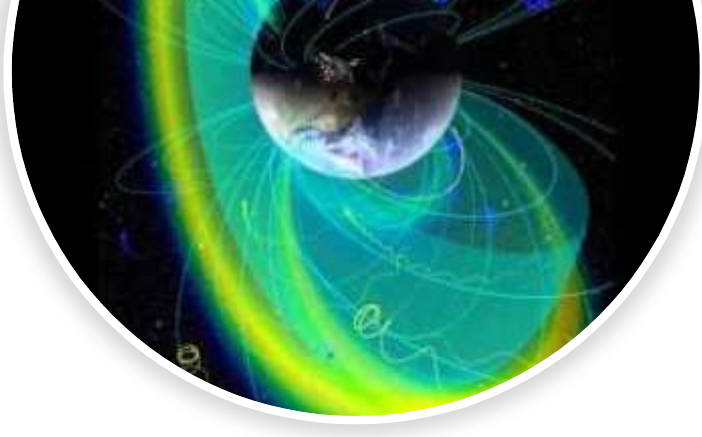
NSF values community input



NASEM Decadal Survey
for Solar and Space
Physics 2024-2033



NASEM Space
Weather
Roundtable



Commu
Meetings
CEDAR, GEM
SWW



Thank you

NSF Funding:
new.nsf.gov/funding

NSF Staff:
nsf.gov/staff