

NSF Support for Space Weather Operations & Research Infrastructure

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Search for Geospace Facilities PD

- Need to fill this position with permanent civil servant position
 - Application deadline closes Sep 14 2020
 - [USAJobs](#) and search NSF AGS
- Looking for scientists with broad experience and a desire to serve the community
- Seek out me or any GS PO for more information

USAJOBS

Physical Scientist (Program Director)

[National Science Foundation](#)

Overview

[Locations](#)

[Duties](#)

[Requirements](#)

[Required Documents](#)

[Benefits](#)

Overview

[Help](#)

Open & closing dates

🕒 08/12/2020 to 09/14/2020

Service

Excepted

Pay scale & grade

AD 04

Salary

\$147,458 to \$189,056 per year

Appointment type

Permanent

Work schedule

Full-Time



Arecibo Update



- Aug 10 Auxiliary Cable failure damaged both the dish and Gregorian Dome
 - Remains offline while stabilization efforts are conducted
 - NSF working closely with AOMT to determine root cause



Space Weather Research



PFISR



SWMF

$$\begin{aligned}\frac{\partial \rho}{\partial t} + \nabla \cdot [\rho \vec{u}] &= 0 \\ \frac{\partial (\rho \vec{u})}{\partial t} + \nabla \cdot \left[\rho \vec{u} \vec{u} + \left(p + \frac{B^2}{8\pi} \right) \vec{I} + \frac{1}{4\pi} \vec{B} \vec{B} \right] &= 0 \\ \frac{\partial \vec{B}}{\partial t} + \nabla \cdot [\vec{u} \vec{B} - \vec{B} \vec{u}] &= 0 \\ \frac{\partial (\rho E)}{\partial t} + \nabla \cdot \left[\vec{u} \left(\rho E + p + \frac{B^2}{8\pi} \right) - \vec{B} (\vec{u} \cdot \vec{B}) \right] &= 0 \\ \nabla \cdot \vec{B} &= 0 \\ p &= (\gamma - 1) \left[E - \frac{1}{2} \rho u^2 - \frac{1}{2} B^2 \right]\end{aligned}$$

Alfvén

- Support investigators using observations, modeling, and theory to advance fundamental understanding of space weather and related processes

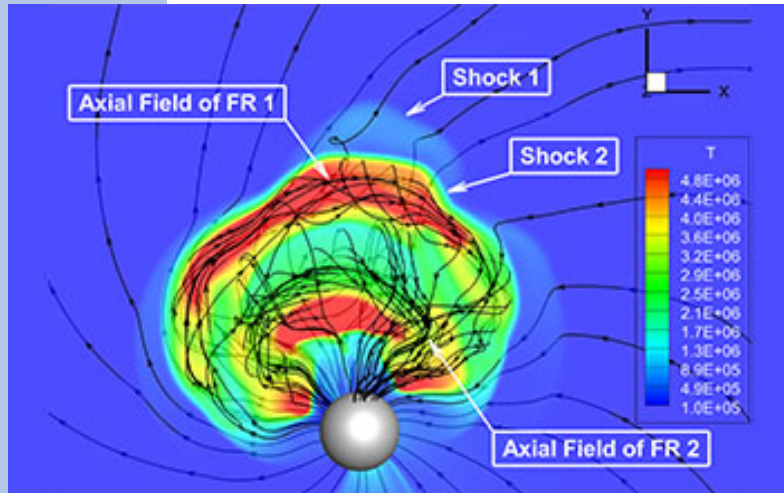


SWQU Selections

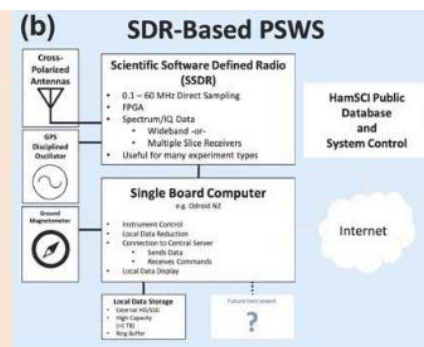
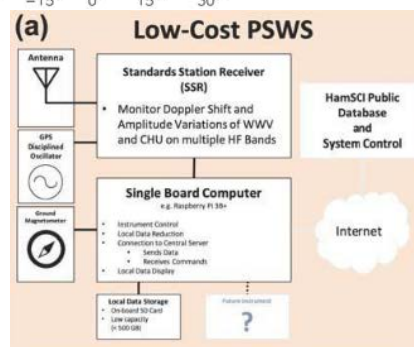
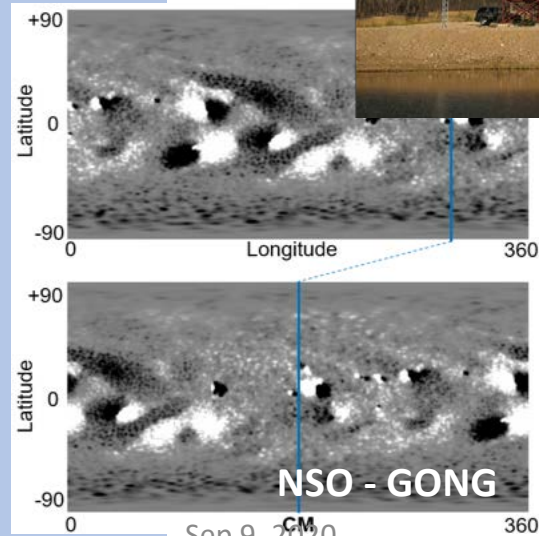
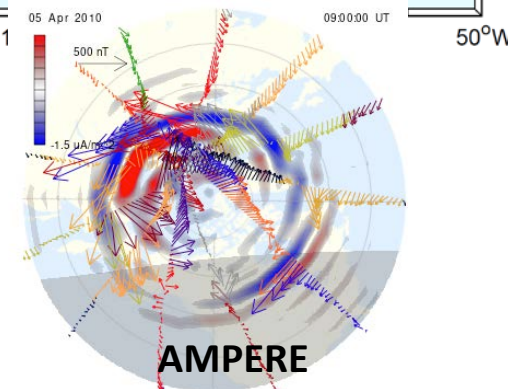
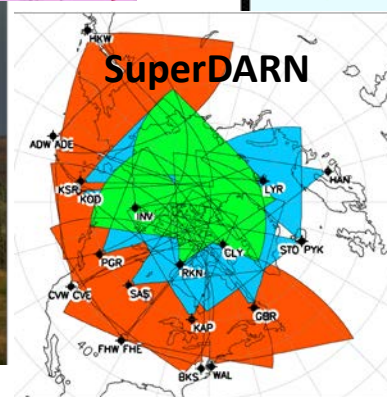
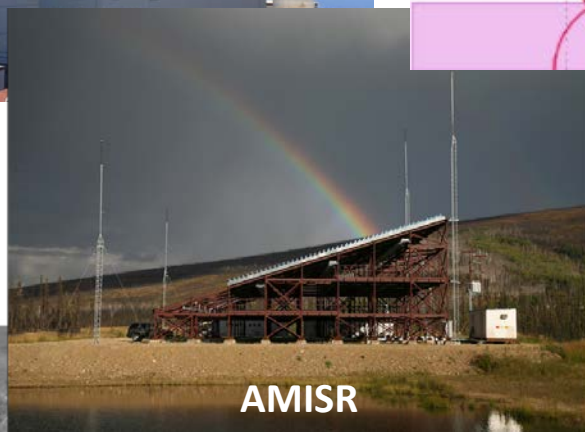
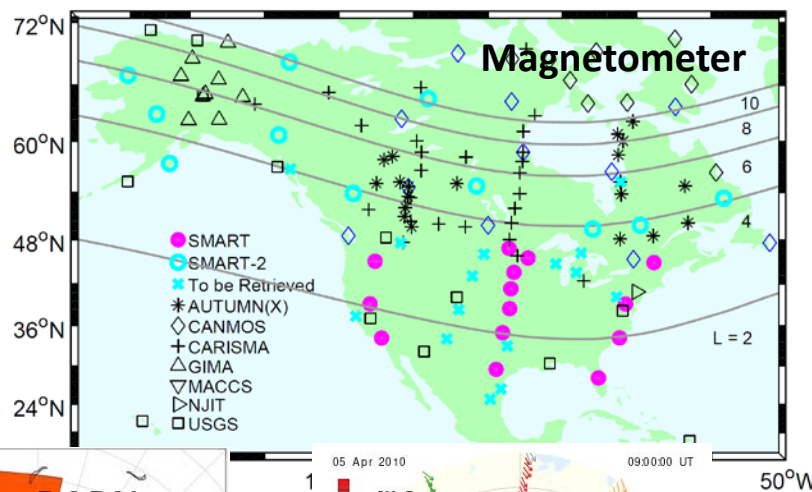
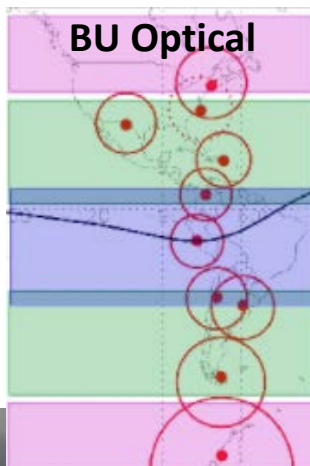
- Partnership between NASA and NSF GEO/MPS Directorates funded 6 awardees efforts to develop next generation space weather models

Awardees

- (NSF+NASA) Improving Space Weather Predictions with Data-Driven Models of the Solar Atmosphere and Inner Heliosphere (PI: N. Pogorelov, U. Alabama at Huntsville)
- (NSF) NextGen Space Weather Modeling Framework Using Data, Physics and Uncertainty Quantification (PI: G. Toth, U. Michigan)
- (NASA) Ensemble Learning for Accurate and Reliable Uncertainty Quantification (PI: E. Camporeale, CU Boulder)
- (NSF) Composable Next Generation Software Framework for Space Weather Data Assimilation and Uncertainty Quantification (PI: R. Linares, MIT)
- (NASA) A Flexible Community-based Upper Atmosphere Ensemble Prediction System (PI: A. Ridley, U. Michigan)
- (NSF) Forecasting Small-Scale Plasma Structures in the Earth's Ionosphere-Thermosphere System (PI: T.-W. Fang; CU Boulder)



NSF Vast Array of Observing Approaches



Sep 9, 2020

NAS Sp Wx R&O Infrastructure Workshop



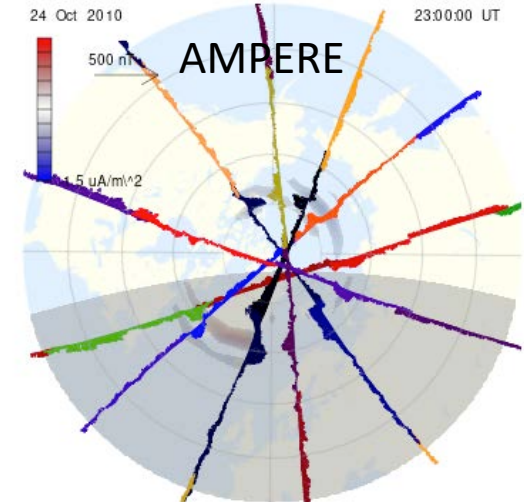
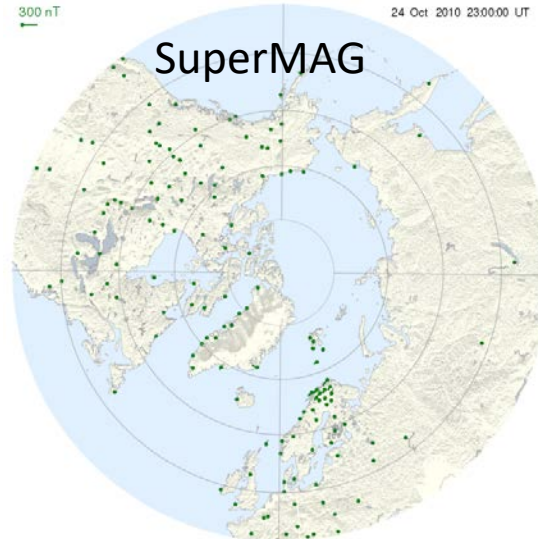
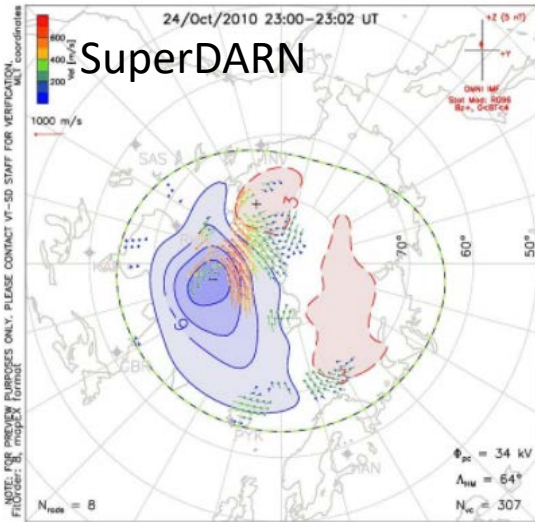
DKIST Update



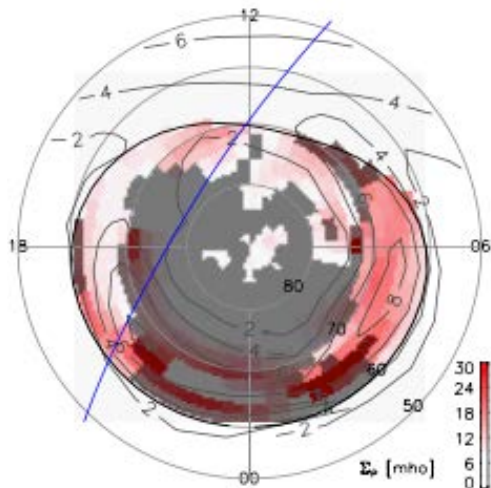
- Construction resumed on June 4 after COVID-19 shutdown
 - DKIST project office determining cost/schedule impacts
- Telescope optics (M1-M10) in place and aligned
- Sunlight down to Coudé instrument lab
- Challenges
 - Delivery and integration of instruments
 - Completion of facility thermal systems



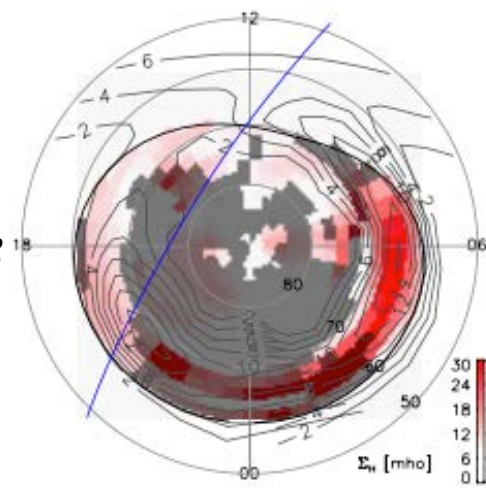
Coupled System Science



$$\mathbf{J} = \sigma_{||} E_{||} \mathbf{B} + \sigma_P \mathbf{E}_{\perp} + \sigma_H \mathbf{B} \times \mathbf{E}_{\perp}$$

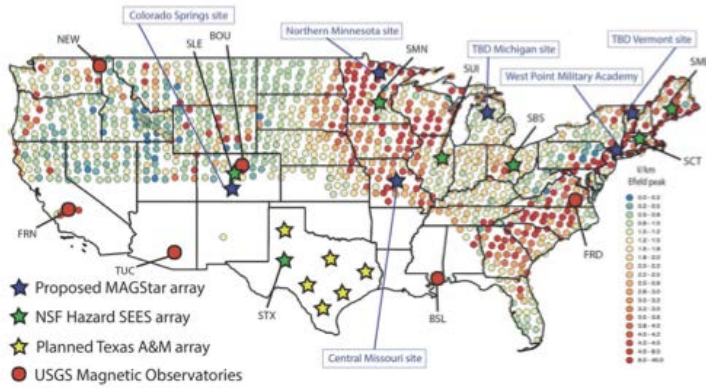


Green et al, 2007 JGR





DASI Awards – Next Gen Observations

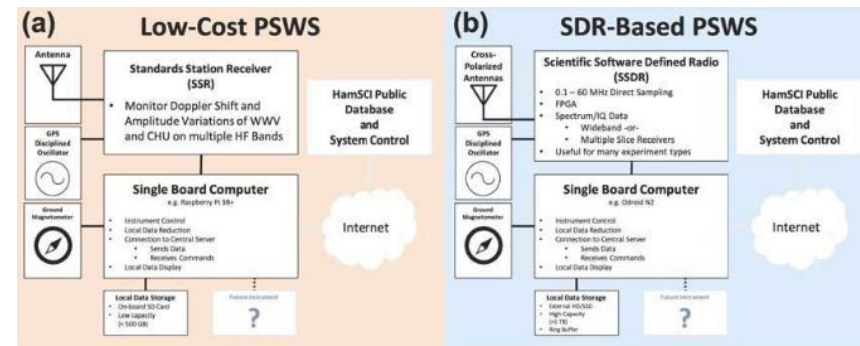


- MagStar

- PI – Gannon – CPI
- Add six new magnetometer stations for GIC studies

- Personal Space Wx Station

- PI – Frissell – U of Scranton
- Collab with Ham Radio operators for Sp Wx Obs

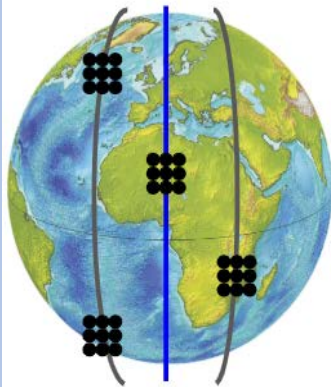


- Space Wx Underground

- PI – Smith – UNH
- Uses undergraduate and high school students to develop and deploy magnetometers

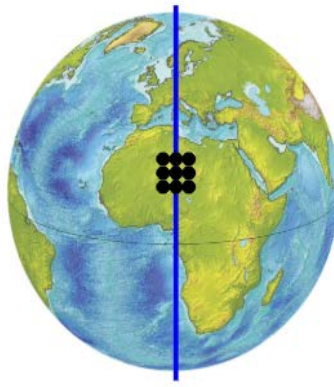
Innovating CubeSat Techniques

CON-SWARM-EX



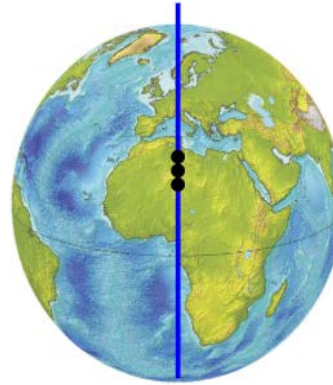
Global Scale
Measurements

SWARM-EX



Regional Scale
Measurements

Mini-SWARM-EX



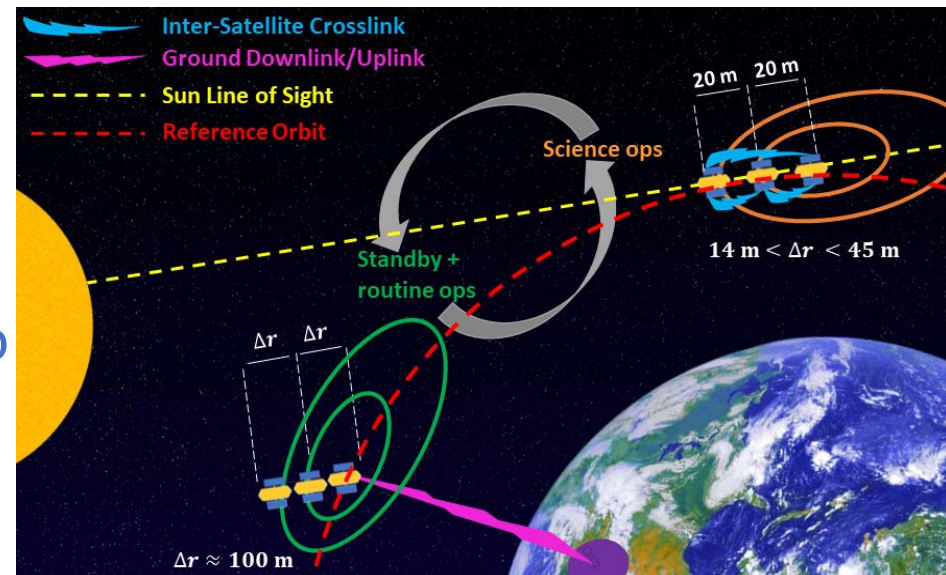
Local Scale
Measurements

• SWARM-EX

- PI – Palo – CU
- Constellation for studies of ionosphere and thermosphere

• VISORS

- PI – Kamalabadi – UIUC
- 3 CubeSats acting as single solar telescope to study coronal heating





Mid-scale Solicitation



- Mid-scale 1 – NSF-19-537
 - Implementation projects - \$6-20M
 - Design projects - \$600K-20M
 - Received around 250 proposals seeking \$2.5B and 42 were invited to submit
 - 10 Awards totaling \$94M
 - 3 Design projects and 7 implementation projects
- Mid-scale 2 – NSF-19-542
 - Supports major shared community infrastructure and resources as may be required to enable community-scale research.
 - Implementation projects between \$20-70M
 - Received 48 proposals requesting \$2B and 14 were invited to submit full proposals



NOAA-NASA-NSF R2O2R Partnership

- Through a MOU NSF is an active partner in the tri-agency partnership supporting R2O2R activities
 - Currently emphasis on supporting efforts related to the transition of models into operations
 - Need to consider pathways for observing systems
 - GONG and Neutron Monitors are examples of current systems in need of this pathway
- Support for R2O2R is a way to satisfy the Broader impact criteria required for all NSF awards





Final Thoughts

- NSF's focus is on basic research into the processes that drive space weather
- Support a wide range of observations
- 'SWORM' era is marked by significant cooperation and collaboration between the agencies involved with space weather



Thank you – Questions?

- Happy to provide answers 😊

