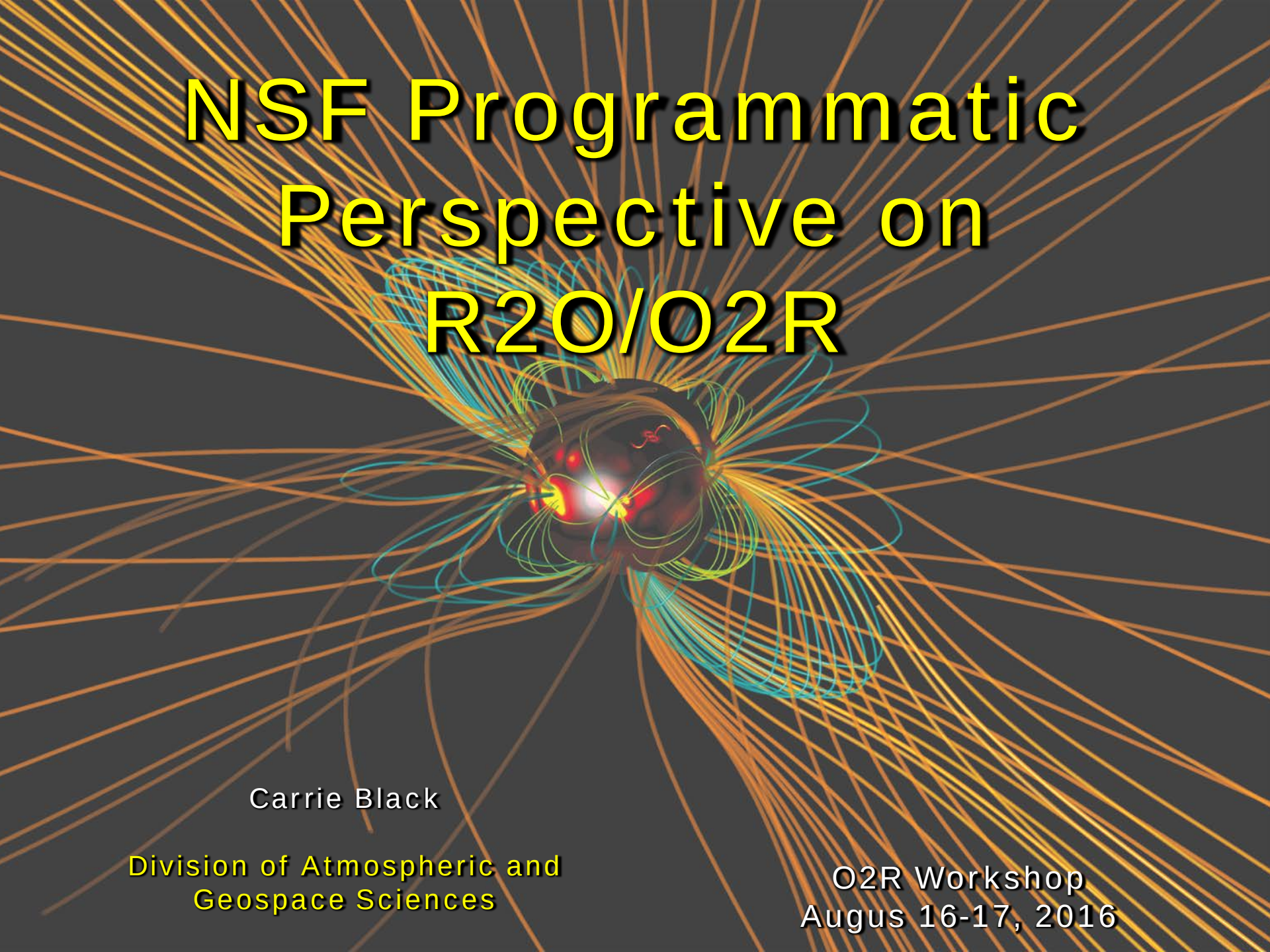
NSF Programmatic Perspective on R2O/O2R



Carrie Black

Division of Atmospheric and Geospace Sciences

O2R Workshop
Augus 16-17, 2016

Outline

- NSF Mandate
- Current NSF Funding for Space Weather
- Potential Gaps that require NOAA funding/where NSF can co-fund

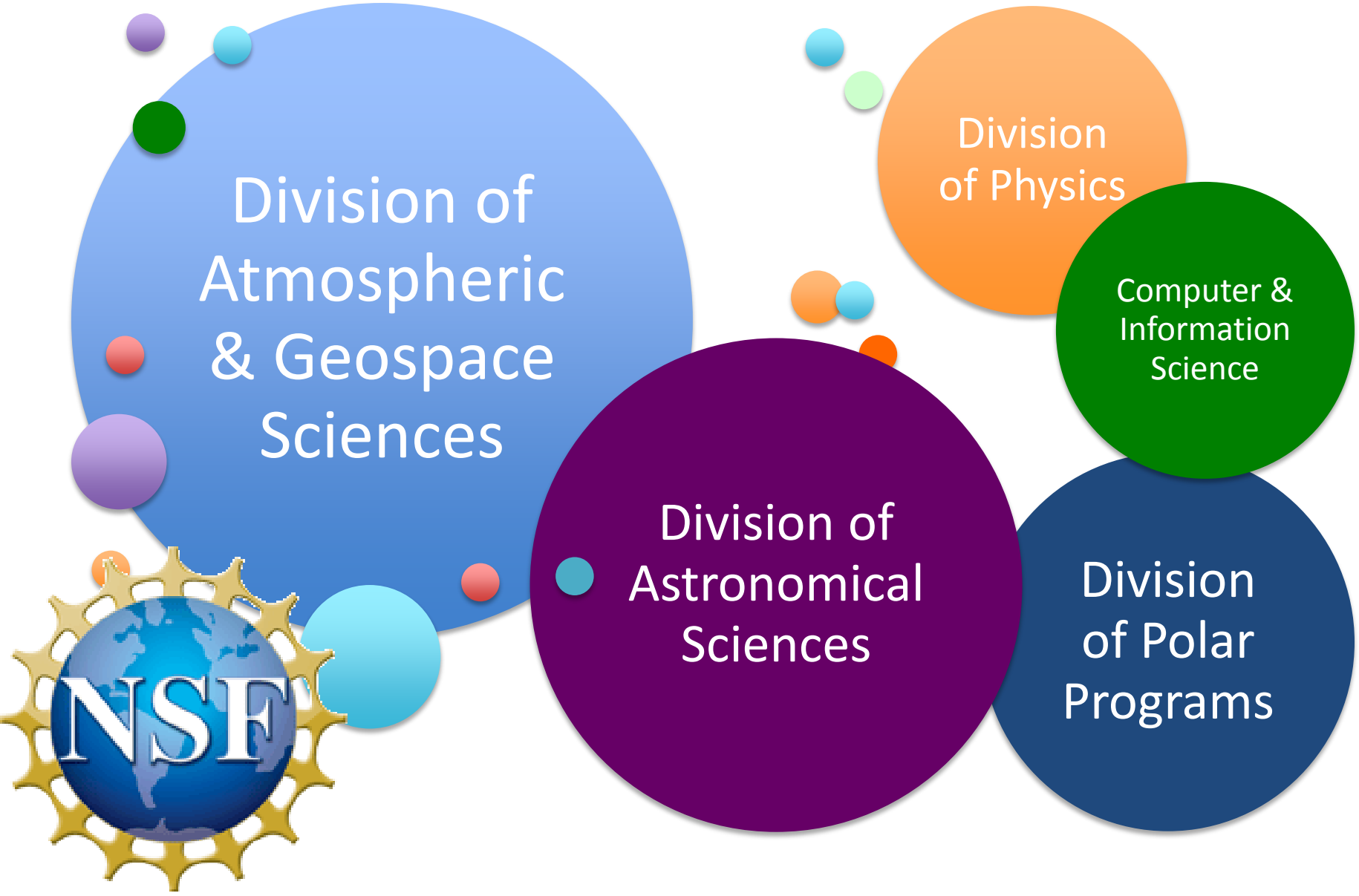
NSF Mandate

- **Foundation's organic legislation authorizes us to engage in the following activities:**
- **A.** Initiate and support, through grants and contracts, scientific and engineering research and programs to strengthen scientific and engineering research potential, and education programs at all levels, and appraise the impact of research upon industrial development and the general welfare.
- **D.** Foster and support the development and ***use of computers*** and other scientific methods and technologies, primarily for research and education in the sciences.

NSF's role: Pursuit of the fundamentals

- Our goal is advancing understanding of the fundamental physical processes responsible for solar eruptive events, propagation of disturbances through the inter-planetary medium, and their interaction with the Earth's magnetosphere and upper atmosphere, and for tropospheric forcing of the upper atmosphere.

Solar, Space Physics & Aeronomy at NSF



Space Weather throughout NSF

- *NCAR: High Altitude Observatory:*
  - Mauna Loa Solar Observatory; Spectro-polarimetric instrumentation; Solar modeling; Global ionosphere and upper atmosphere model development, including WACCM-X.
- *Division of Polar Programs:*
  - Neutron monitor network in Arctic and Antarctic ("Ice Cube"); Antarctic component of SuperDARN as well as other ground-based instruments that provide observations for geospace research.

Space Weather Throughout NSF

- *Division of Astronomical Sciences*:
  - The National Solar Observatory (NSO) operates solar telescopes, including DKIST under construction, and conducts solar physics research.
  - The GONG network in collaboration with NOAA is used operationally: provides synoptic (full disk) information of flares, filaments, prominences, and the fine structure of active regions as well as the global magnetic field of the Sun.
- *Division of Mathematical and Physical Sciences:*
  - NSF/DOE Partnership in Basic Plasma Science and Engineering
  - Space Plasma Processes

Space Weather in AGS

- *CEDAR, GEM, and SHINE Programs*
  - Facilitate research collaboration on coupling and interaction
- *NASA/NSF Collaborative Space Weather Modeling*
  - Supports large-scale space weather modeling efforts that require collaborative community teamwork
- *Community Coordinated Modeling Center, Goddard*
  - Support the development of models for transition to operations
- *AMPERE, SuperDARN and SuperMAG*
  - Global networks of space weather relevant observations
  - Exploring real-time capabilities
- *Potential Future Developments*
  - Enhanced global network
  - New advanced instruments, e.g. CoSMO
  - Collaborative efforts to address large cross-disciplinary problems, e.g. Heliophysics Science Centers

Geospace Programs FY 2016

SPACE WEATHER *Vacant* **$6.2M**	**SOLAR-TERRESTRIAL** *Illia Roussev* **$7.8M**	**MAGNETOSPHERE** *Janet Kozyra* **$7.1M**
AERONOMY *Ruth Lieberman* **$9.3M**	**FACILITIES** *John Meriwether* **$14.3M**	**$45.2M** **Up 4% over FY 2015**

We are expecting at best a flat budget for FY17.

Funding Opportunities

- At this time, there are no changes to the GS programs and no augmentations to the budgets
  - STR: SHINE Deadline- December 14, 2016
  - Mag: GEM Deadline- October 15, 2016
  - AER: CEDAR Deadline- July 17, 2017
- Unsolicited

Funding Opportunities

- EAGER : EARly-concept Grants for Exploratory Research
  - Potentially transformative research
    - High risk high reward
  - Up to $300k for 2 years
- RAPID: Rapid Response Research
  - Severe urgency, usually in response to a natural disaster
  - Up to $200k for 1 year

- Talk to your PO

PREEVENTS: Prediction of and Resilience Against Extreme Events

- Basic purpose
  - Better understand risks posed by GEO-relevant natural hazards and extreme events through basic geoscience research, in order to help increase resilience and reduce impacts on life, society, and the economy
- Primary targets – **must address both to be eligible**
  - Enhance understanding of fundamental processes underlying natural hazards and extreme events on various scales, and variability inherent in such hazards/events
  - Improve capability to model and forecast such hazards and events
- Subsidiary – encouraged, but not required
  - Improve understanding of effects of natural hazards/extreme events
  - **Enable** development, **with other support**, of tools to enhance societal resilience

PREEVENTS cont.

- Track 1 – Workshops
- Track 2 – Science Proposals
  - Letters of Intent due July 29, 2016
  - Full Proposals due September 19, 2016
  - Total Funding ~$18M
- Solicitation likely every 2 years

NSF can support O2R through joint funding of research projects

- Can fund are projects that overlap with O2R
- Can potentially co-fund projects with NOAA, DOD, and NASA that have components such as:
  - New observations that lead to operational improvements (Explore the value of Global Network data or new observing capabilities (i.e. neutral) for operations)
  - Data assimilation and data fusion techniques
  - New physical understanding that lead to operational model improvements
  - Code optimization, efficiencies, and robustness

Broader Impacts

- Science results that lead to operational improvements is a broader impact.
- Grassroots engagement to train students, forecasters, the public, etc. on scientifically correct use of tools.
- Establishing new collaborations with operations staff


Thank you!

R2O/O2R Communications in NSF Funded Workshops

- Not clear what the scientific benefit is
- **Remote-Sensing Observing Techniques for Improving Space-Weather Science and Forecasting**

- **Flux-Rope CMEs: Predicting Bz**

- Doug Beisecker, Alysha Reinard

Space Weather throughout NSF

- *for Atmospheric and Geospace Science (AGS)*: Aeronomy, Magnetospheric Physics, and Solar-Terrestrial Research, including the directed community programs, CEDAR (Coupling Energetics & Dynamics of Atmospheric Regions), GEM (Geospace Environment Modeling), and SHINE (Solar Heliospheric and INterplanetary Environment), and major incoherent scatter radar and lidar observational facilities in the Geospace Facilities program.
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- *Dedicated Space Weather Research program in AGS since 2013*
- Large-scale space weather model development in collaboration with NASA; The Community Coordinated Modeling Center in collaboration with NASA; Distributed global observation networks: SuperDARN, AMPERE; CubeSat program.
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- *Basic research relevant to space weather at NCAR's High Altitude Observatory:*
- Mauna Loa Solar Observatory; Spectro-polarimetric instrumentation; Solar modeling; Global ionosphere and upper atmosphere model development, including WACCM-X.
-
- *Basic research relevant to space weather in the Division of Polar Programs:*
- Neutron monitor network in Arctic and Antarctic ("Ice Cube"); Antarctic component of SuperDARN as well as other ground-based instruments that provide observations for geospace research.
-
- *Space weather projects in NSF-wide and Geosciences Directorate programs:*
- Several projects with relevance to Space Weather were funded under the Frontiers in Earth System Dynamics program; In FY15 an award on GIC research was made under the SEES Hazards program; Extreme space weather as a natural hazard is a defining part of an upcoming new program at NSF named Prediction of and Resilience against Extreme Events (PREEVENTS).
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- *Solar science in the Division for Astronomy and Astrophysics*: The National Solar Observatory (NSO) operates solar telescopes, including DKIST under construction, and conducts solar physics research.
- The GONG network in collaboration with NOAA is used operationally: provides synoptic (full disk) information of flares, filaments, prominences, and the fine structure of active regions as well as the global magnetic field of the Sun.

Funding of Space Weather Research

- Through STR, Mag and AER, we fund the basic physics research relevant to space weather operations.
  - Examples Here
  - CCMC
- Data collection/ facitilies relevant to Operations that
  - are already incorporated are…
  - could be incorporated are AMPERE…