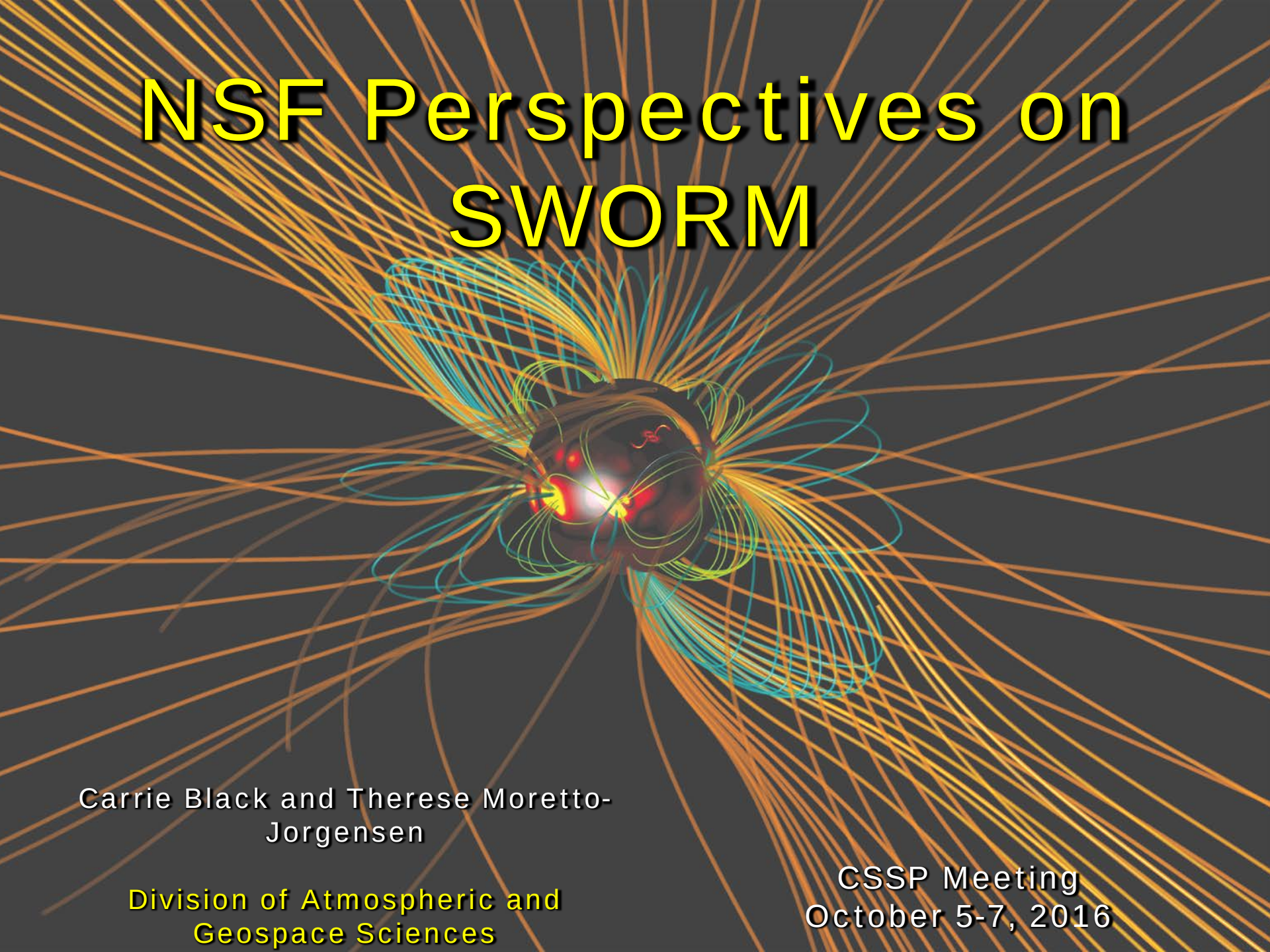
NSF Perspectives on SWORM



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Division of Atmospheric and Geospace Sciences

CSSP Meeting
October 5-7, 2016

Fundamental Research

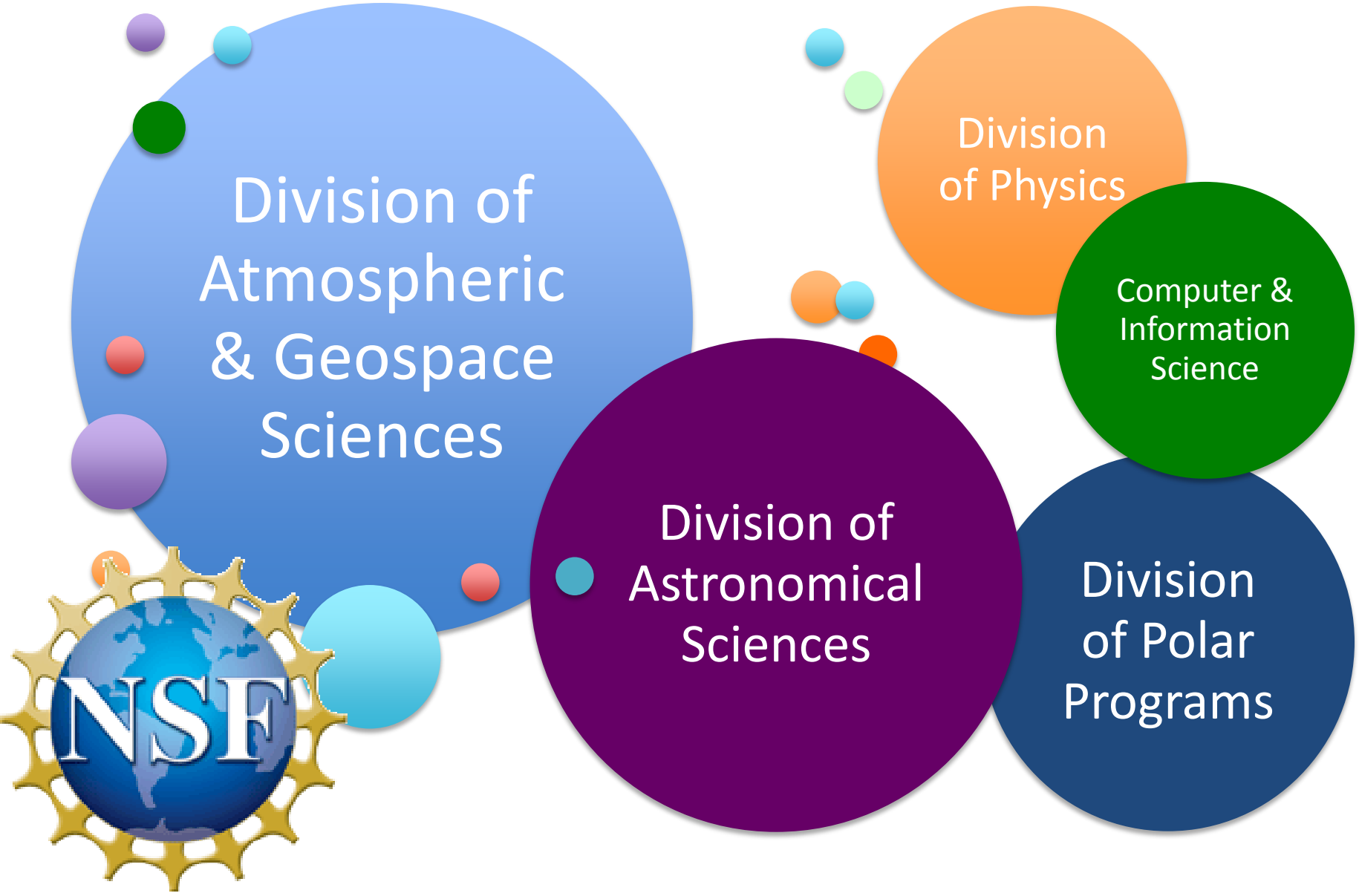
- Basic research in solar and space physics is critical for progress on space weather specification and forecasting capabilities

- Space Weather is a highly immature science understanding of very many of the fundamental physical processes and interactions are rudimentary at best

NSF Participation SWORM

- Goal 1 Benchmarks (6,12, and 24 months timelines)
  - Phase 1: Initial benchmarks based on existing studies
  - Phase 2: Development of scientifically and statistically rigorous benchmarks
    - (12 months) Developing plans for engaging the scientific community – in collaboration with NASA
- Goal 4 Improve Assessment, Modeling, and Prediction of Impacts on Critical Infrastructure
  - Supporting role in 4.2.6 (12mo), 4.2.2 (36 mo)
- Goal 5 Improve Space Weather Services through Advancing Understanding and Forecasting
  - (5.3, 5.4, 5.5 - 5.5.1 NSF led 12 mo deadline, 5.6)
  - 5.5.1 Document R&D priorities
    - This is where basic research comes in to play
  - 5.6.1 / 5.6.2 activity
    - Strengthening ties with NASA through new MOUs
    - Co-conveners of an O2R workshop led by NOAA
- Goal 6 Increase International Cooperation (6.2, 6.4)

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***

R2O/O2R for Space Weather

- The focus of the community is largely on R2O for models given the youth of the science.
- O2R is important for the space weather enterprise.
- The establishment of an O2R center as presented would help strengthen the links between the scientific and the operational communities.
- This would create a pathway for joint NSF-NOAA-DOD targeted research programs with the dual purpose of enhancing physical understanding and improving operations.

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!