Air Force Research Laboratory

Space Sciences at AFOSR

09 May 2017

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AFOSR/RTB1
Air Force Research Laboratory

Integrity ★ Service ★ Excellence

AFOSR Science and Technology Strategy

Mission: Discover, shape, and champion basic science that profoundly impacts the future Air Force

Identify breakthrough research opportunities here & abroad

- 26 Arlington-based Program Officers and 18 International Program Officers interacting with leading scientists and engineers across the globe
- 3 International offices (London, Tokyo, Santiago)

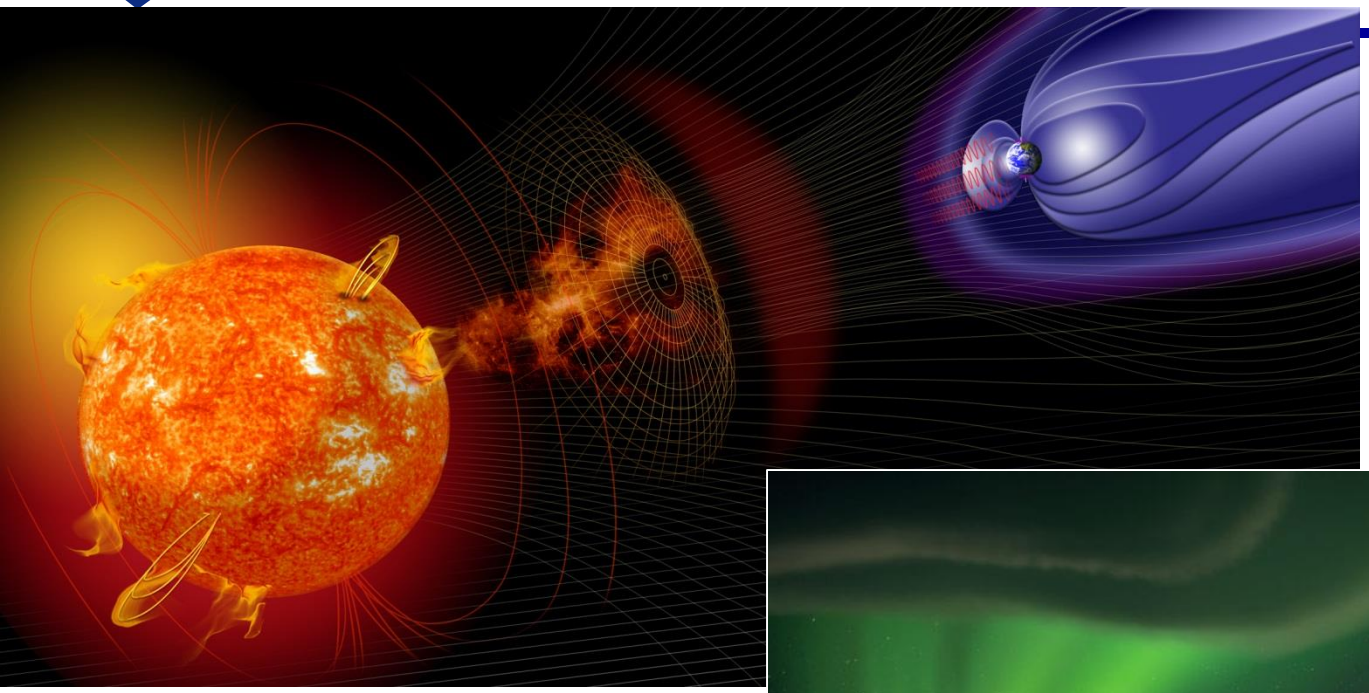
Foster revolutionary basic research for Air Force needs

- 1166 research projects in FY16
  - 190 U.S. institutions
  - 46 States
- 293 intramural projects at AFRL, USAFA, and AFIT in FY16
- In FY16 384 international efforts in 43 countries in 5 continents

Transition technologies to DoD and industry

- AFRL is the principal technology transition path
- 38 SBIR/STTR contracts funded with FY16 funds
- Entrepreneurial impact: >1600 patents; 74 spin-off companies

Space Science – The Science of the Sun-Earth Environment



Space Science Enables Space Weather Forecasting

How to apply for funds

How is AFOSR different?
- Portfolio vision
- Program Officer has discretion

The Opportunities

- Read and respond to Broad Agency Announcement – on grants.gov – search AFOSR BAA
- DURIP – equipment grants – due 7 July 2017
- YIP – Young Investigator Program – due 1 June 2017
- MURI – Multidisciplinary University Research – special topics

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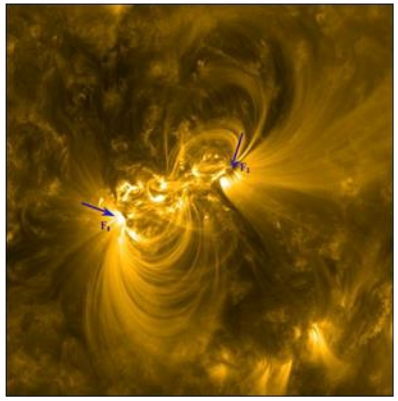
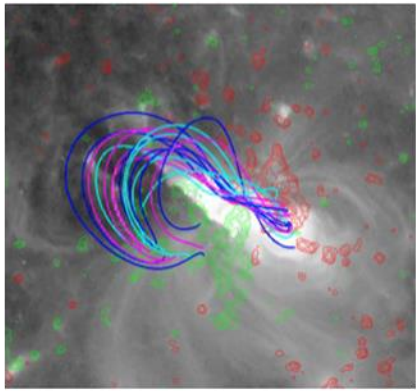
The Proposal

- White paper
- Abstract : Please say what you are going to do
- Body of proposal: Make the case for why. What is the outstanding science question?
- Research Plan: Please outline what you will do.

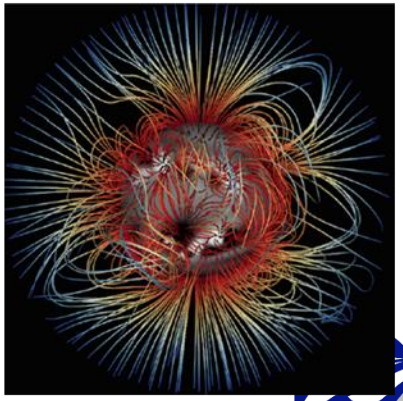
Subarea 1:Sun-Earth Connection: Solar Photosphere and Corona

- Can solar disturbances be predicted by observing, understanding, and modeling structures and fields on the sun?
- How are disturbances ejected into the corona? What happens to internal fields and structures during the eruption?
- How important is knowledge of the solar far side and poles to the accuracy of the models?





Model field lines projected on solar images



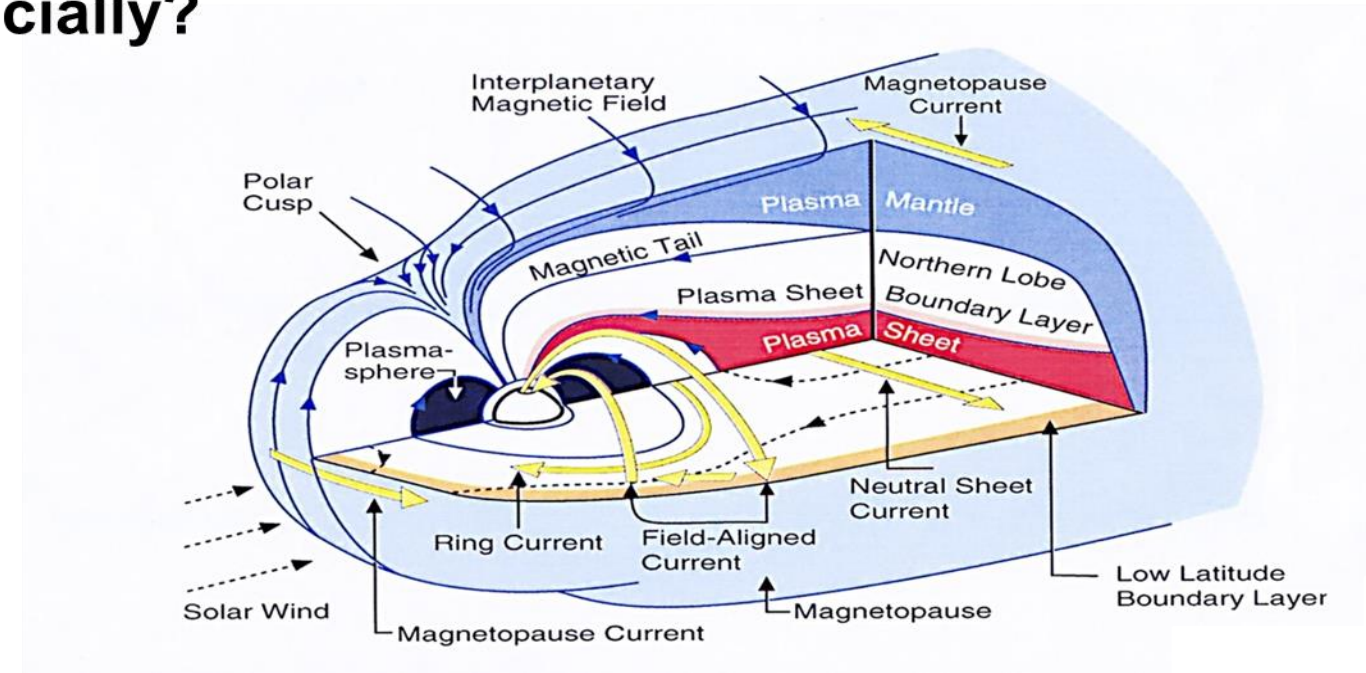
Solar Magnetic Field

Subarea 1: Sun-Earth Connection: Solar Wind Effects at Earth

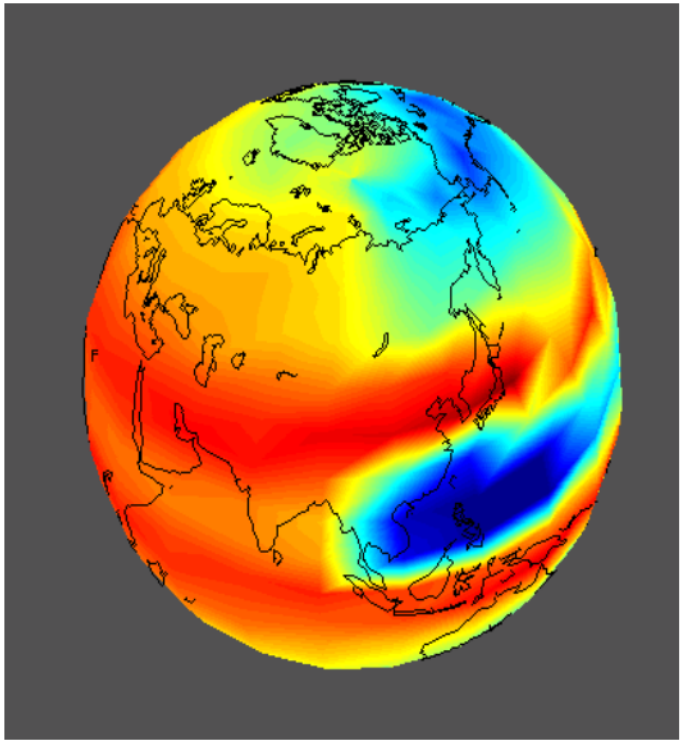
- How do fields and plasma structures transition between the corona and solar wind?
- How does the magnetic field evolve between the sun and the earth? Can it be observed and/or modeled?
- How do interplanetary coronal mass ejections affect geospace on the dayside? On the nightside? Can the intensity of the response be predicted?

Subarea 2: Magnetosphere/Plasmasphere

- What physical processes determine the flux and intensity of high energy particles in the magnetosphere and radiation belts?
- What is the physics of entry and exit of energetic particles? Can emptying of the belts be enhanced artificially?



Subarea 3: I-T Coupling: Ionosphere/Atmosphere

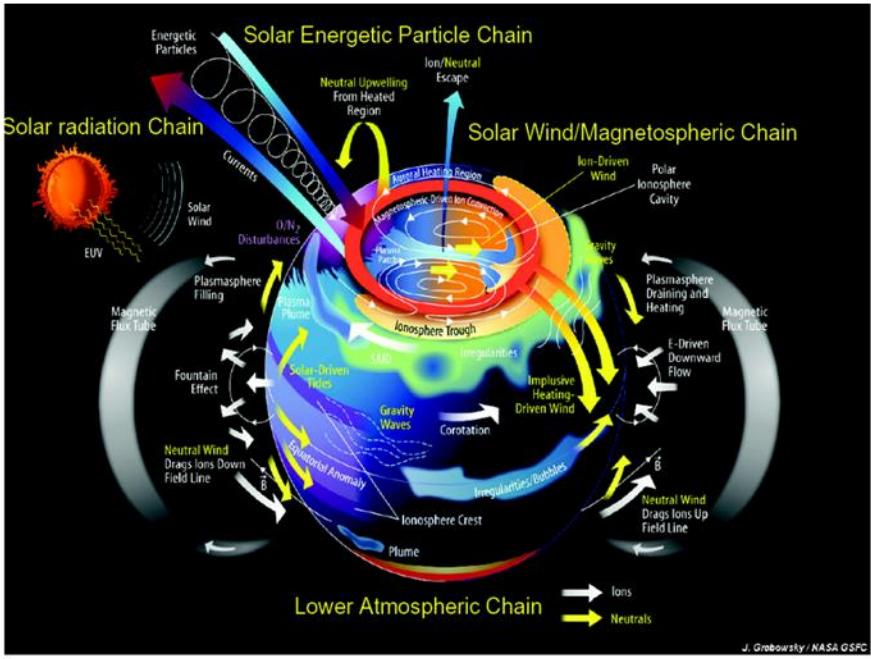


Total Electron Content (TEC)

- How does energy flow into and through the ionosphere and atmosphere?
- What are significant sources of energy input into the polar cap?
- How do localized energy sources affect the ionosphere and atmosphere globally?

Subarea 3: I-T Coupling: Ionospheric Structure and Dynamics

- What physical processes – natural or artificial – generate small scale structures and turbulence in the ionosphere?
- What are the precursors to small scale structure in the ionosphere? Can they be predicted?
- Can atmospheric density changes be predicted through data assimilation into improved models?

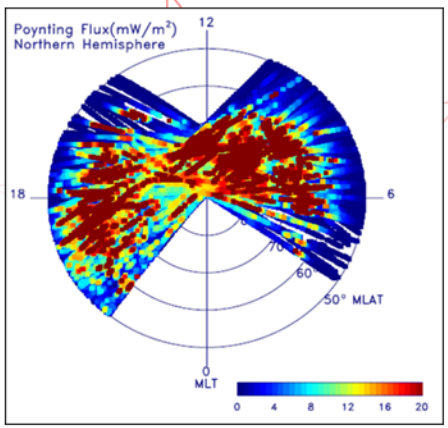


MURI Active Ionosphere-Thermosphere Coupling: Mechanisms and Effects

Title: Next Generation Advances in Ionosphere-Thermosphere Coupling at Multiple Scales for Environmental Specification and Prediction

Kick-off meeting: 5 Dec 2016

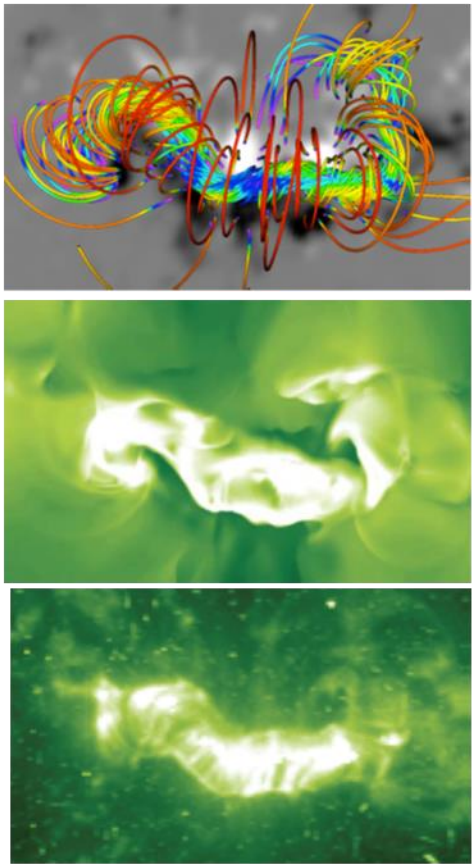
PI: Yue Deng
University of Texas - Arlington

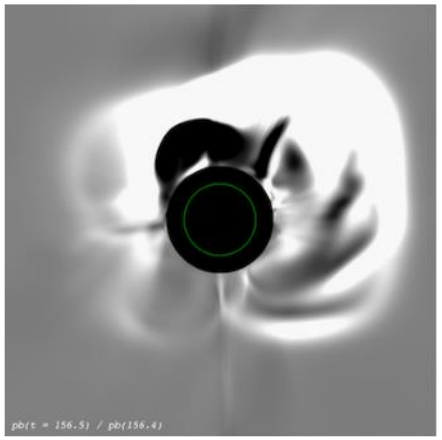


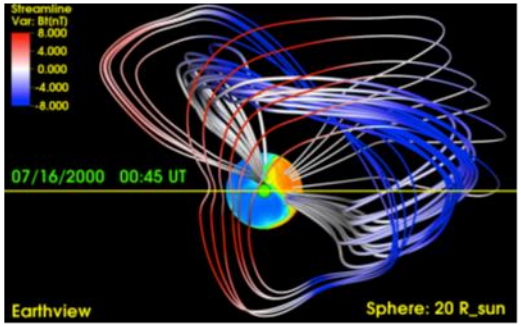
Goals are to
(1) discover the spatial distribution and temporal evolution of meso-scale structures in geomagnetic forcing.
(2) develop a new model description to describe the large-scale and meso-scale response of I-T system to the forcing.
(3) describe local and non-local responses of the I-T system that result from large-scale and meso-scale energy inputs at high latitudes.
(4) understand how meso-scale structures and their influence on the I-T system are coupled to the magnetosphere.

Transition

- CORHEL (Corona-Heliosphere) is suite of models for numerically simulating the solar corona and solar wind
- CORHEL has been provided to AFRL Kirtland, AFRL at Maui HPCC, and the Community Coordinated Modeling Center (CCMC) at NASA Goddard
- Our present project is to develop CORHEL-CG, a tool for simulating Coronal Mass Ejections (CMEs) in realistic coronal/solar wind solutions







Simulation of the July 14, 2000 "Bastille Day" CME using TDM Flux Ropes

Dr. Jon Linker, Predictive Science, Inc.

Questions