Heliophysics 2009 Roadmap and Global Change

Possibilities for Improved Understanding of the Connection

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Outline

Why are we here?

Heliophysics is . . .

Overview of 2009 Roadmap

The six science target areas

Summary of possibilities

Challenge for the week

Reminder of why we are here

- This is a diverse gathering
- Our broad diversity is a strength and sets us apart from previous efforts to address this issue
- Coming to common understanding of the state of knowledge of the influence of the Sun-Earth system on Global change is our first goal
- Articulating the next steps for research is the second goal
- Global change extends beyond climate - impacts on technology
- Focus on very long term impacts - decadal +

- The purpose of this week is to assess our level of understanding of the system:

  - by identifying recent advances connecting solar changes to changes in Earth's global environment in the context of changes in greenhouse gases, aerosols, and land cover

  - by identifying gaps in our knowledge

  - by identifying interdisciplinary research topics to improve predictions of solar-terrestrial influences on Earth's global environment and its people in the context of the full range of global change forcings and feedbacks.

In short -- What do we know? What don't we know? What are the **top four research projects** that can improve our present knowledge?

Outcome

Workshop products include:

- a journal review article on the state of knowledge and research outlook
- a popular article for policy makers and the public on the significance of understanding the vulnerabilities related to changes in the entire Sun-Earth system, and their relative contributions to global change
- a joint session at AGU? too late for fall?

Our planet is immersed in a seemingly invisible yet exotic and inherently dangerous environment. Above the protective cocoon of Earth's lower atmosphere exists a highly variable mix of electrified and magnetized matter intertwined with penetrating energetic radiation and extremely fast atomic-sized particles. This environment is created by the interaction of the Earth's magnetic field with the outer atmosphere of our star, the Sun. The Sun's output of energy varies on time scales from milliseconds to billions of years and forms its own complex magnetic fields structure that stretches throughout the solar system. It controls the entry of cosmic rays into the solar system and drives some of the largest changes in the environment affecting our atmosphere, ionosphere, and potentially our climate. This extended atmosphere of the Sun, called the heliosphere, reaches far beyond the orbit of Pluto and affects all planetary bodies in the solar system. It moves through our Milky Way galaxy where it is influenced by slowly changing interstellar conditions that in turn could have consequences for habitability on Earth. This immense volume is our cosmic neighborhood; it is the domain of the science called **Heliophysics**.

Heliophysics is the science that includes all aspects of the research needed to understand the Sun and its effects on the Earth and the solar system.

Overview of Roadmap

The Science

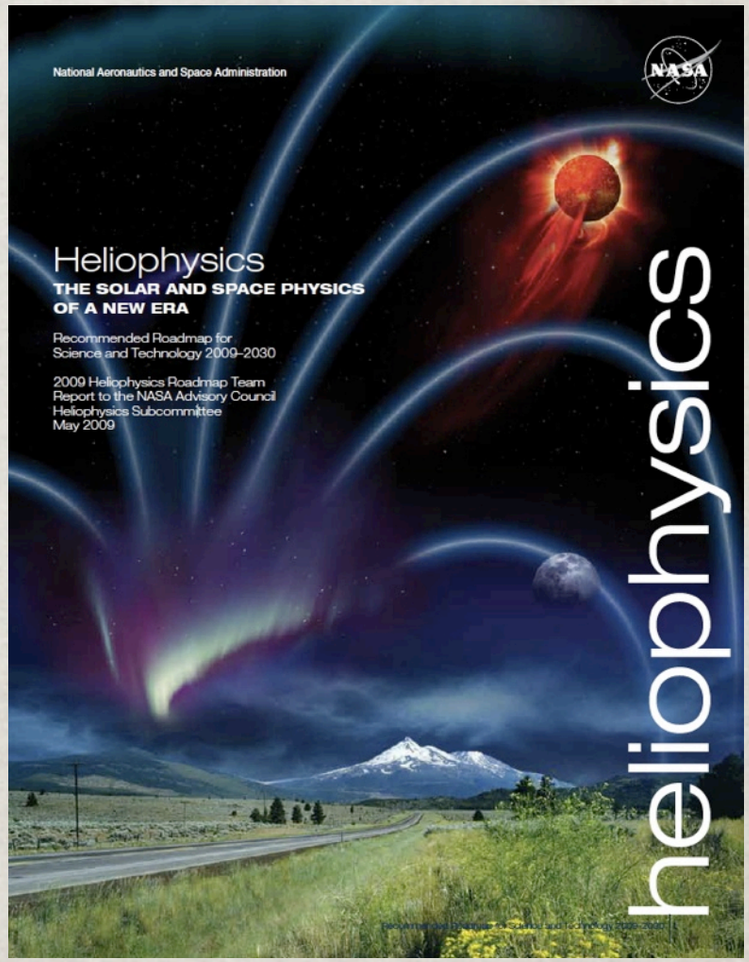
State of the Discipline

Program Elements

Priority Science Targets

Applications

Education and Public Outreach



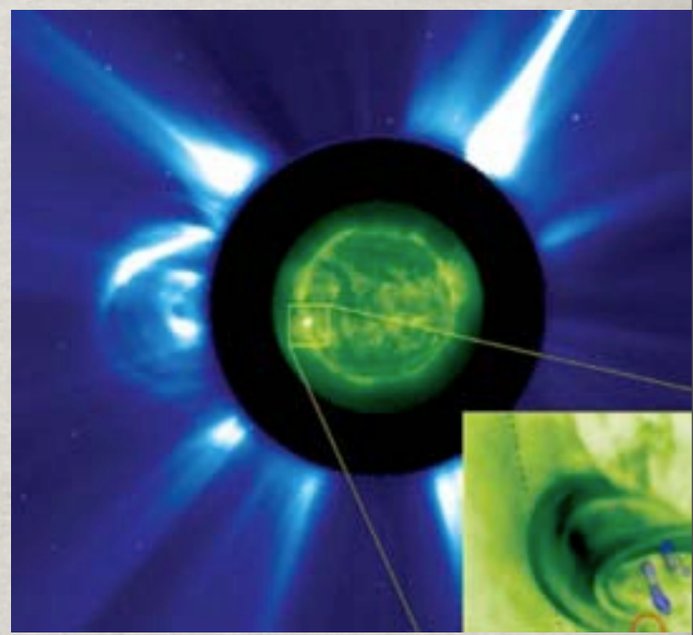
http://science.nasa.gov/about-us/science-strategy/

http://sec.gsfc.nasa.gov/sec_roadmap.htm

Six science targets

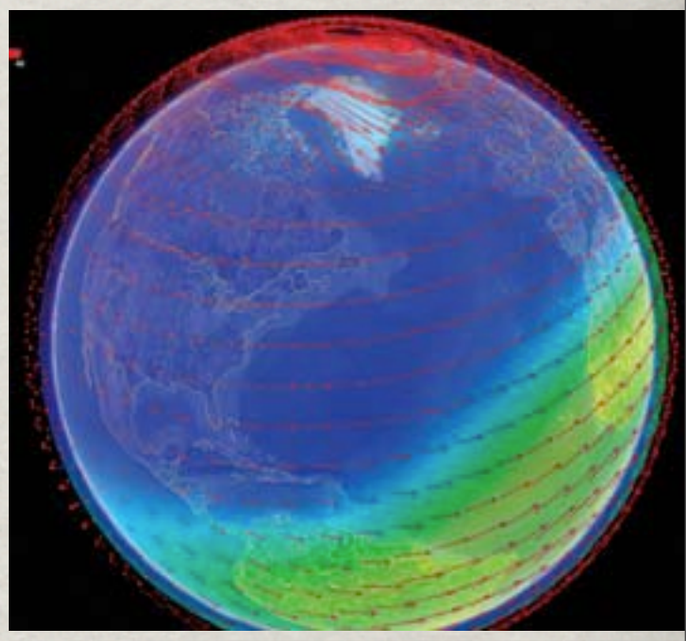
1. Origins of Near-Earth Plasma - to understand the origin and transport of terrestrial plasma from its source to the magnetosphere and solar wind

2. Solar Energetic Particle Acceleration and Transport - to understand how and where solar eruptions accelerate energetic particles that reach Earth



Six science targets

3. Ion-Neutral Coupling in the Atmosphere - to understand how neutral winds control ionospheric variability

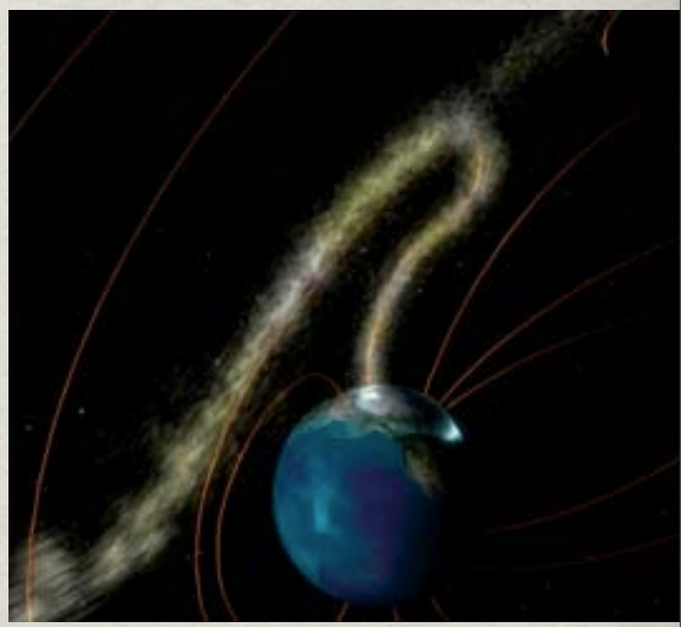


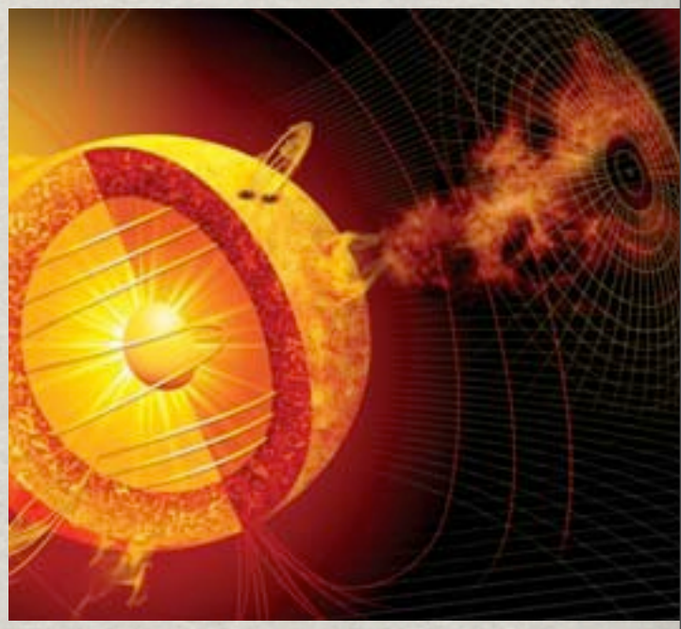
4. Climate Impacts of Space Radiation - to understand our atmosphere's response to auroral, radiation belt, and solar energetic particles, and the associated effects on nitric oxide (NO) and ozone

Six science targets

5. Dynamic Geospace Coupling - to understand how magnetospheric dynamics provides energy into the coupled ionosphere-magnetosphere system

6. Heliospheric Magnetics - to understand the flow and dynamics of transient magnetic structures form the solar interior to Earth





Challenge for this week

is to articulate

(a) what do we know? (b) what don't we know? and (c) what are the **top four research projects** that can improve our present knowledge?

and then to commit to publishing

(1) a review journal article and (2) a popular science article, on the significance of understanding the vulnerabilities related to changes in the entire Sun-Earth system, and their relative contributions to global change