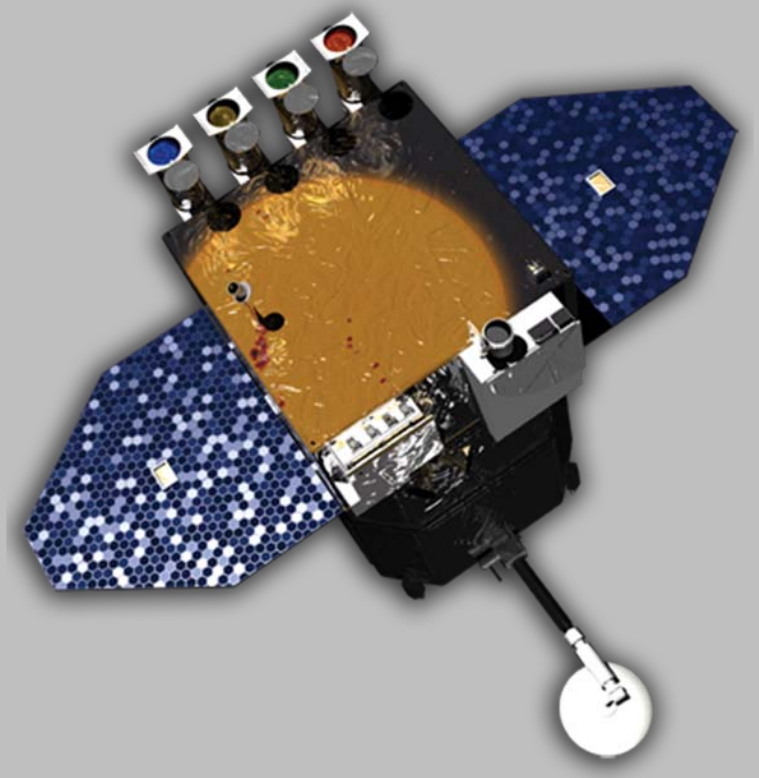
The Solar Dynamics Observatory: Ready for Solar Cycle 24



W. Dean Pesnell

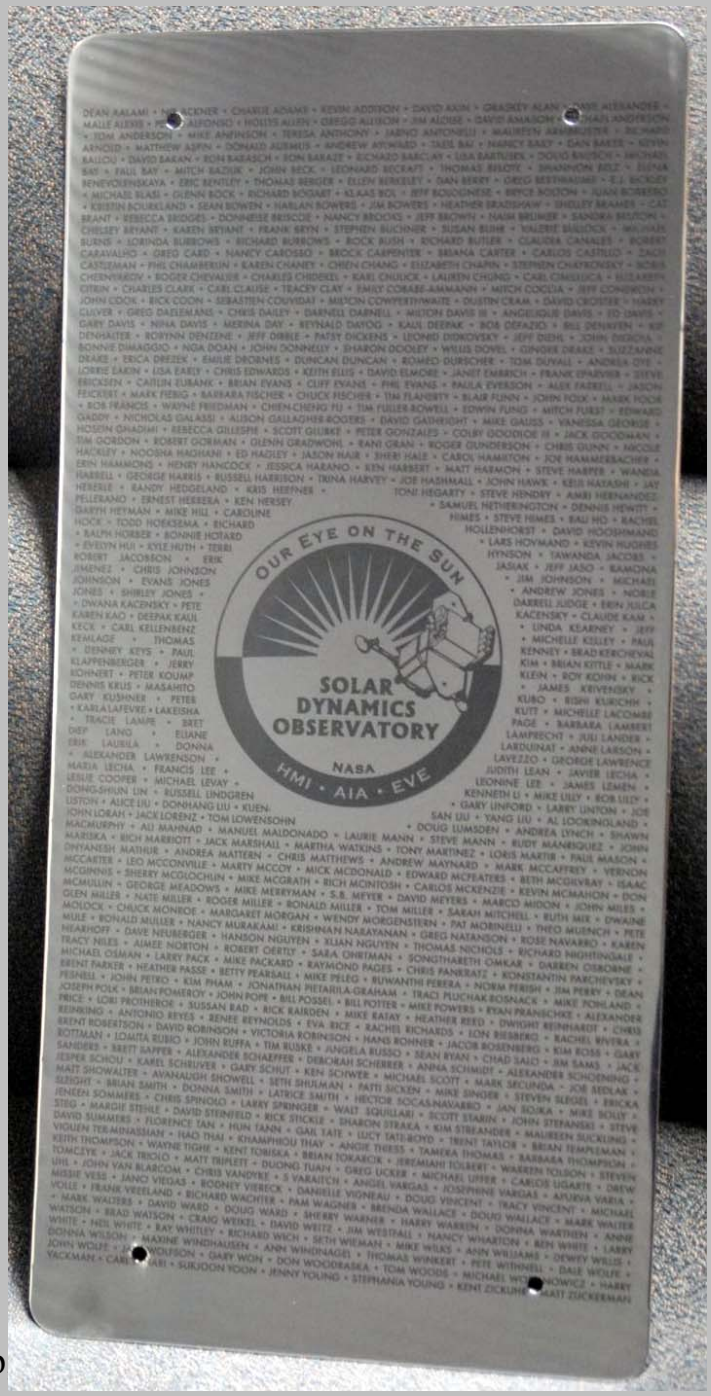
NASA, Goddard Space Flight Center

SDO Project Scientist

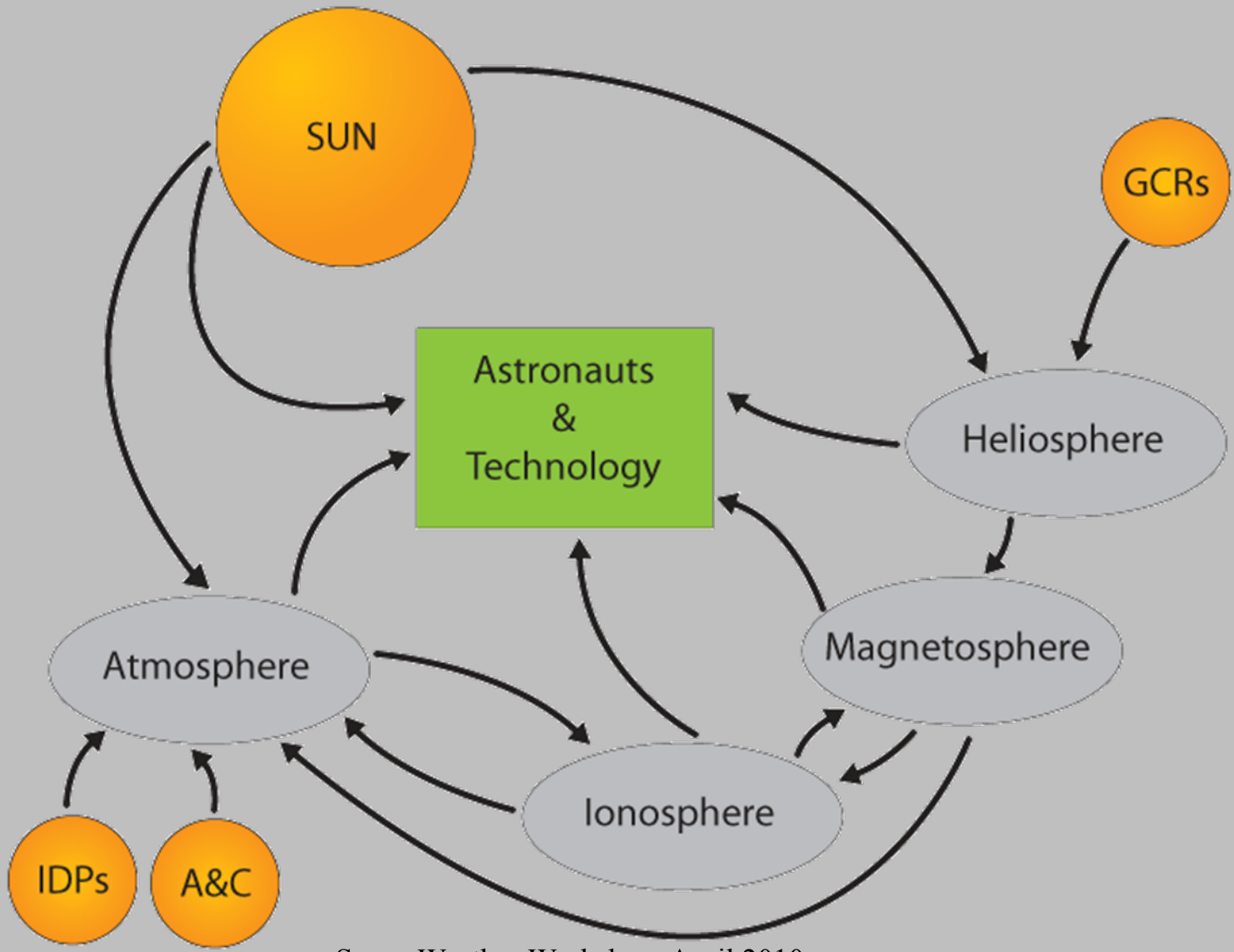
and the SDO Team

Thank You!

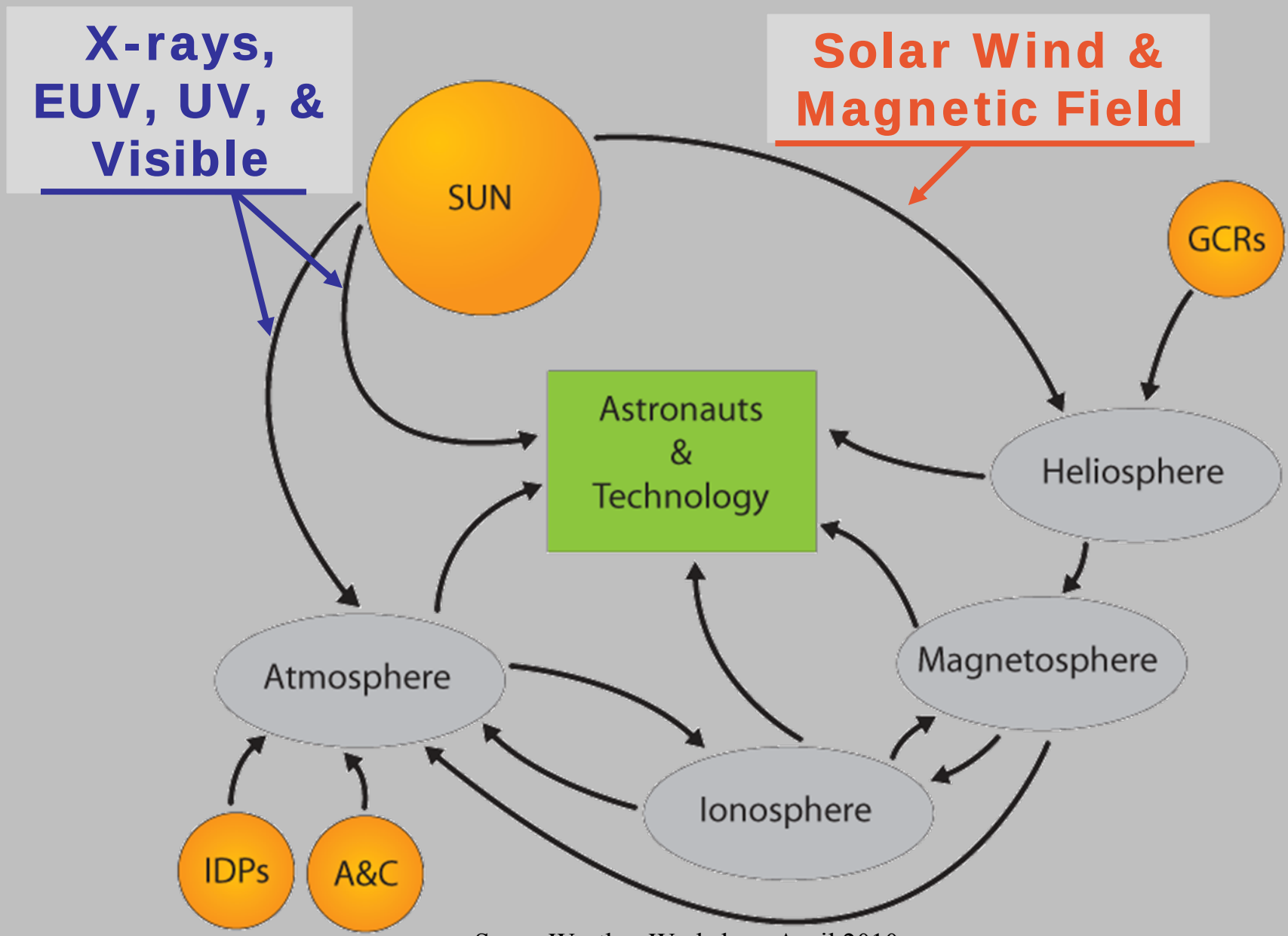
Many people helped to bring SDO to launch. Many of their names are inscribed on a balance weight that is mounted inside the spacecraft.



Space Weather Covers Many Research Areas

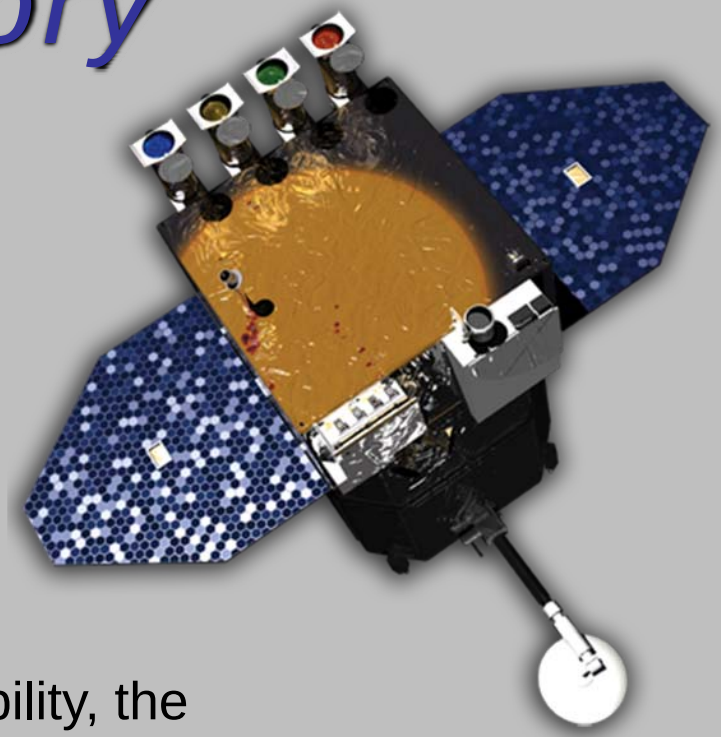


SDO Provides Information About Two



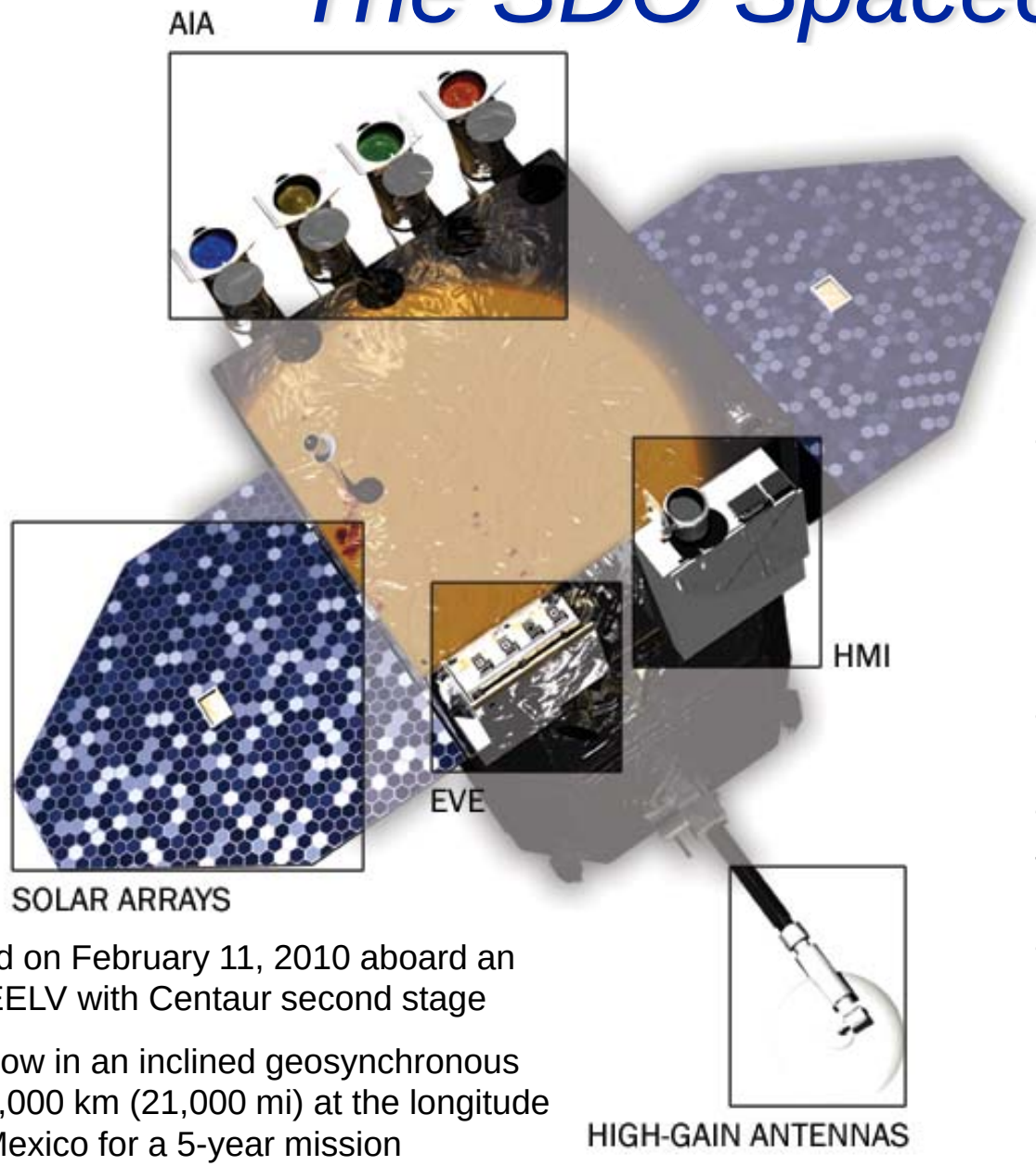
Solar Dynamics Observatory

The Solar Dynamics Observatory (SDO) is the first Living With a Star mission. It will study the Sun's magnetic field, the interior of the Sun, and changes in solar activity. It is designed to be our solar observatory for Solar Cycle 24.



- The primary goal of the SDO mission is to understand, driving towards a predictive capability, the solar variations that influence life on Earth and humanity's technological systems by determining:
  - *–How the Sun's magnetic field is generated and structured*
  - *–How this stored magnetic energy is converted and released into the heliosphere and geospace in the form of solar wind, energetic particles, and variations in the solar irradiance.*

The SDO Spacecraft



Launched on February 11, 2010 aboard an Atlas V EELV with Centaur second stage

SDO is now in an inclined geosynchronous orbit ~36,000 km (21,000 mi) at the longitude of New Mexico for a 5-year mission

The total mass of the spacecraft at launch was 3000 kg (payload 300 kg; propellant 1400 kg).

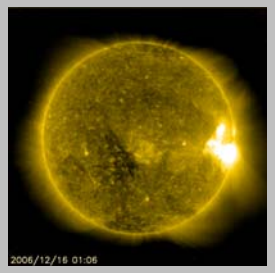
Its overall length along the sun-pointing axis is 4.5 m, and each side is 2.2 m.

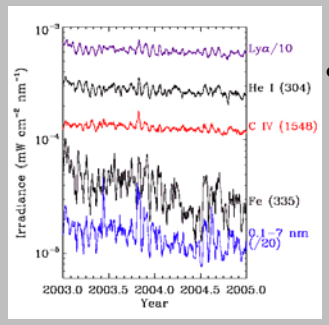
The span of the extended solar panels is 6.25 m.

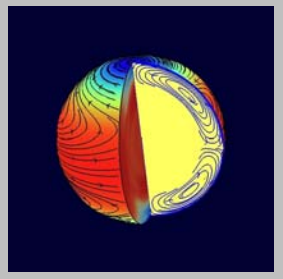
Total available power is 1500 W from 6.6 m^2 of solar arrays (efficiency of 16%).

The high-gain antennas rotate once each orbit to follow the Earth.

SDO Data







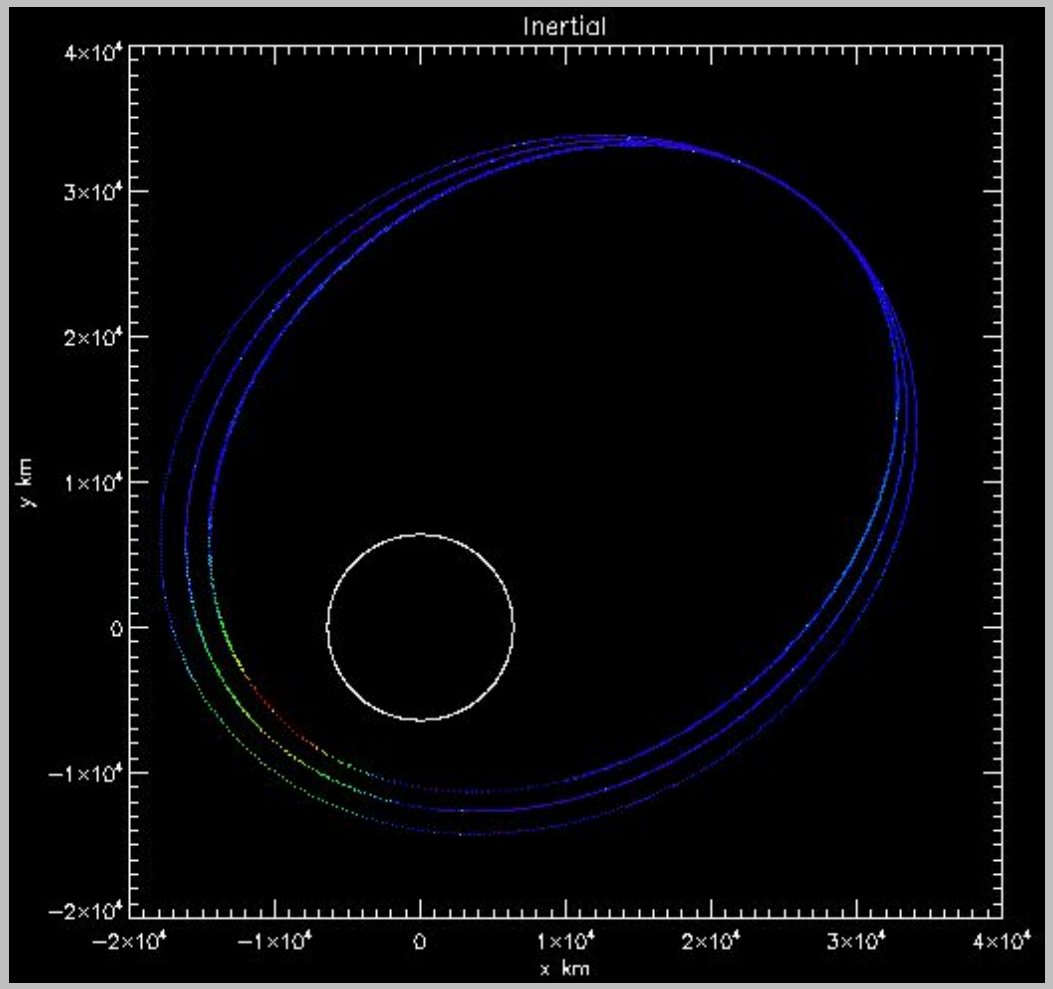
- **Space Weather Needs**
  - Space Weather data will be made available rapidly to all users
  - AIA images will be used for flare predictions
  - HMI will produce far-side images for a total Sun view
  - EVE spectral irradiances will drive models of the thermosphere and ionosphere
- **The Sun as Our Astrophysical Laboratory**
  - Production and destruction of magnetic field is traced by HMI and AIA investigators
    - Only the Sun can give the details of an astrophysical magnetic field
    - Solar & stellar magnetic dynamos are still only qualitatively understood
  - The models of time-dependent convection needed to understand stars and giant planets are validated with HMI data
    - Velocities are measured throughout convection zone
    - Subsurface weather maps will be produced
    - Map out the solar dynamo?
  - Coronal and chromospheric heating
  - How do active regions and coronal loops produce changes in irradiance?
- **We want to know what the Sun is doing today and to predict tomorrow**

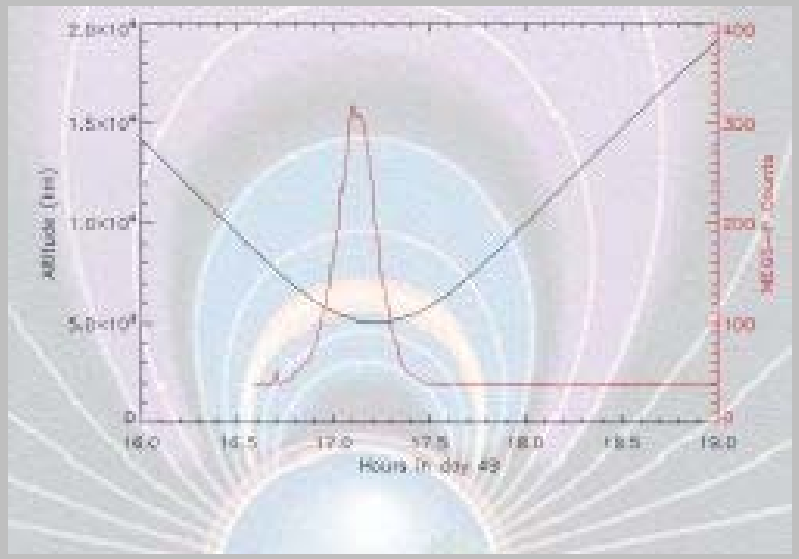
The SDO Spacecraft

On January 21, 2010, SDO was placed inside the fairing that protects it during launch.

A Perfect Launch

EVE & Energetic Protons

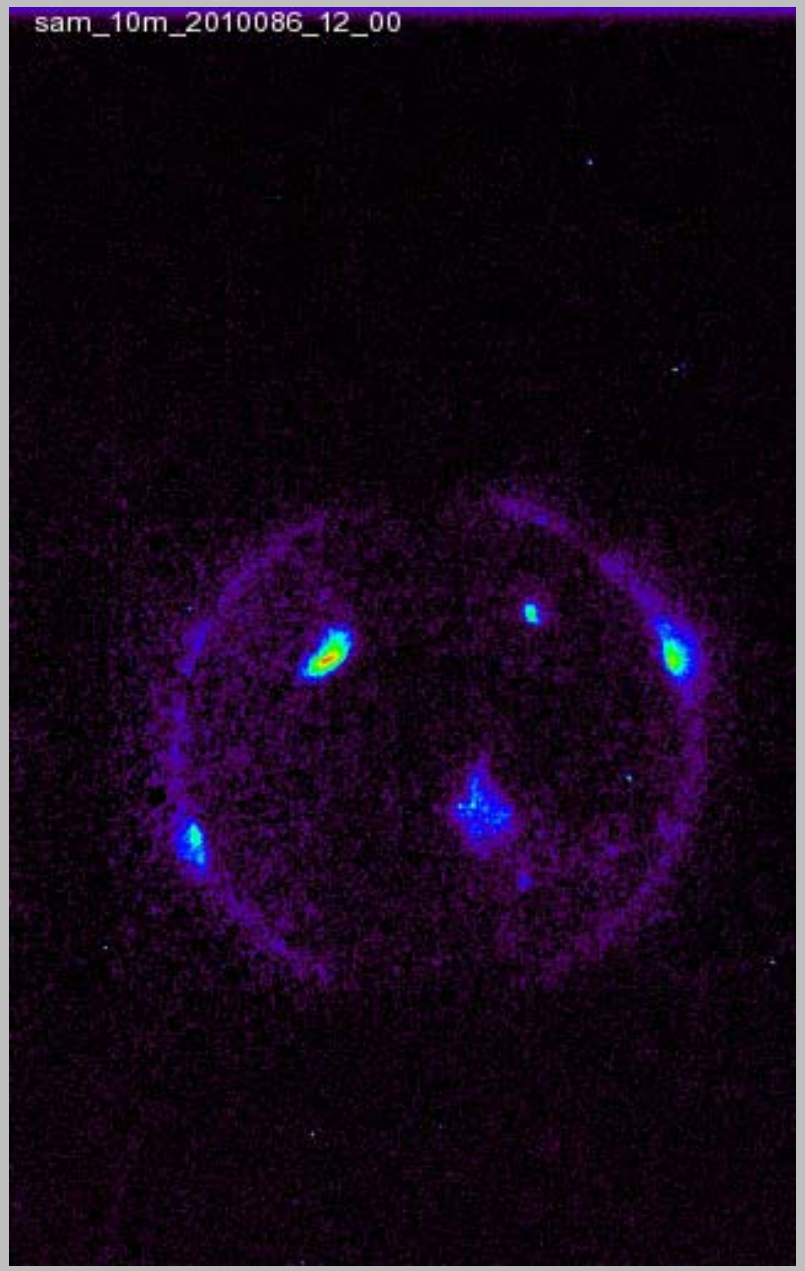




During ascent to geosynchronous orbit the SDO perigee was in the inner radiation belt for several orbits. This allowed the MEGS-P Lyman-α radiometer to map out the energetic protons.

EVE & Energetic Protons

Doors Open / First Light



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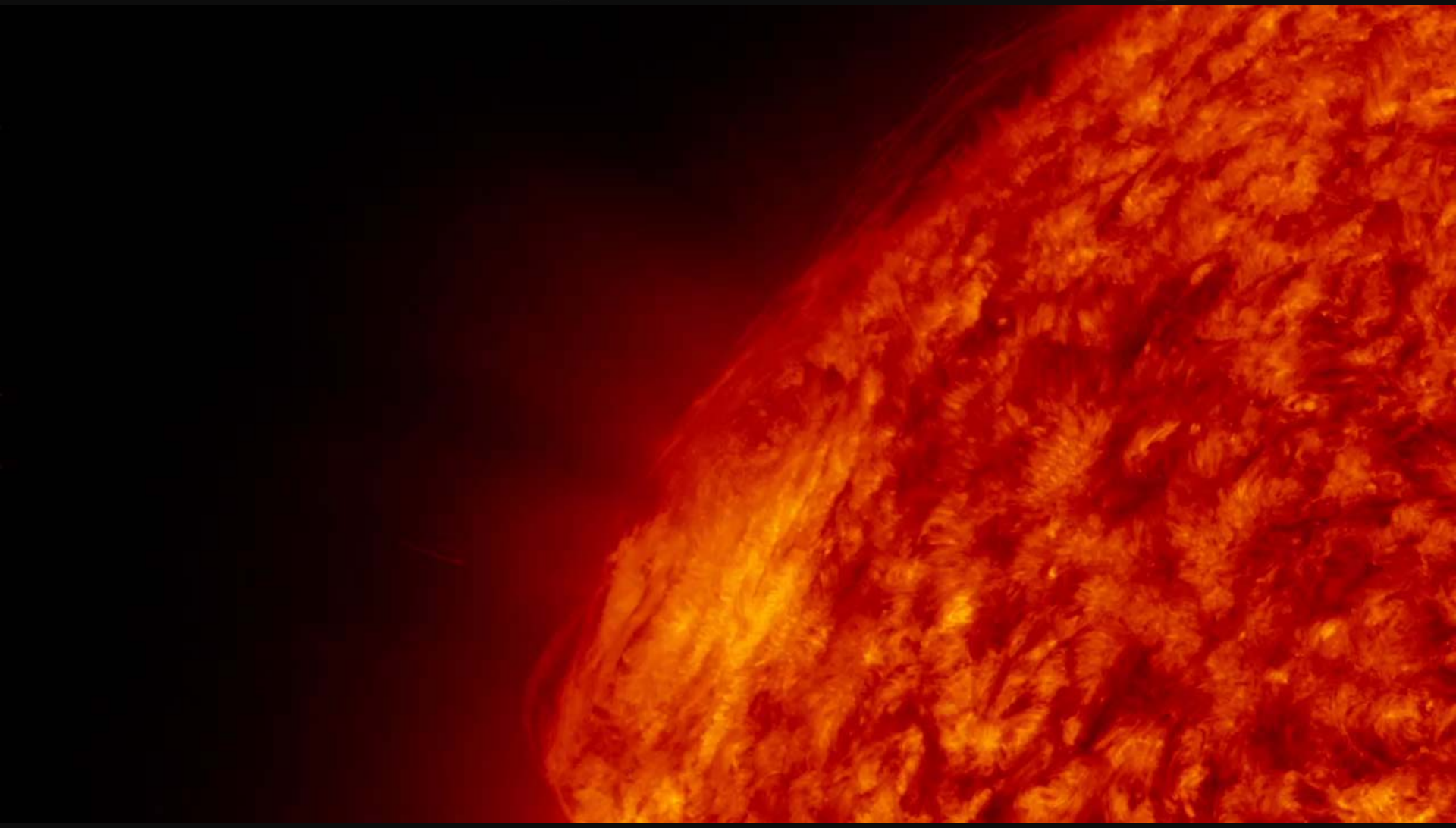

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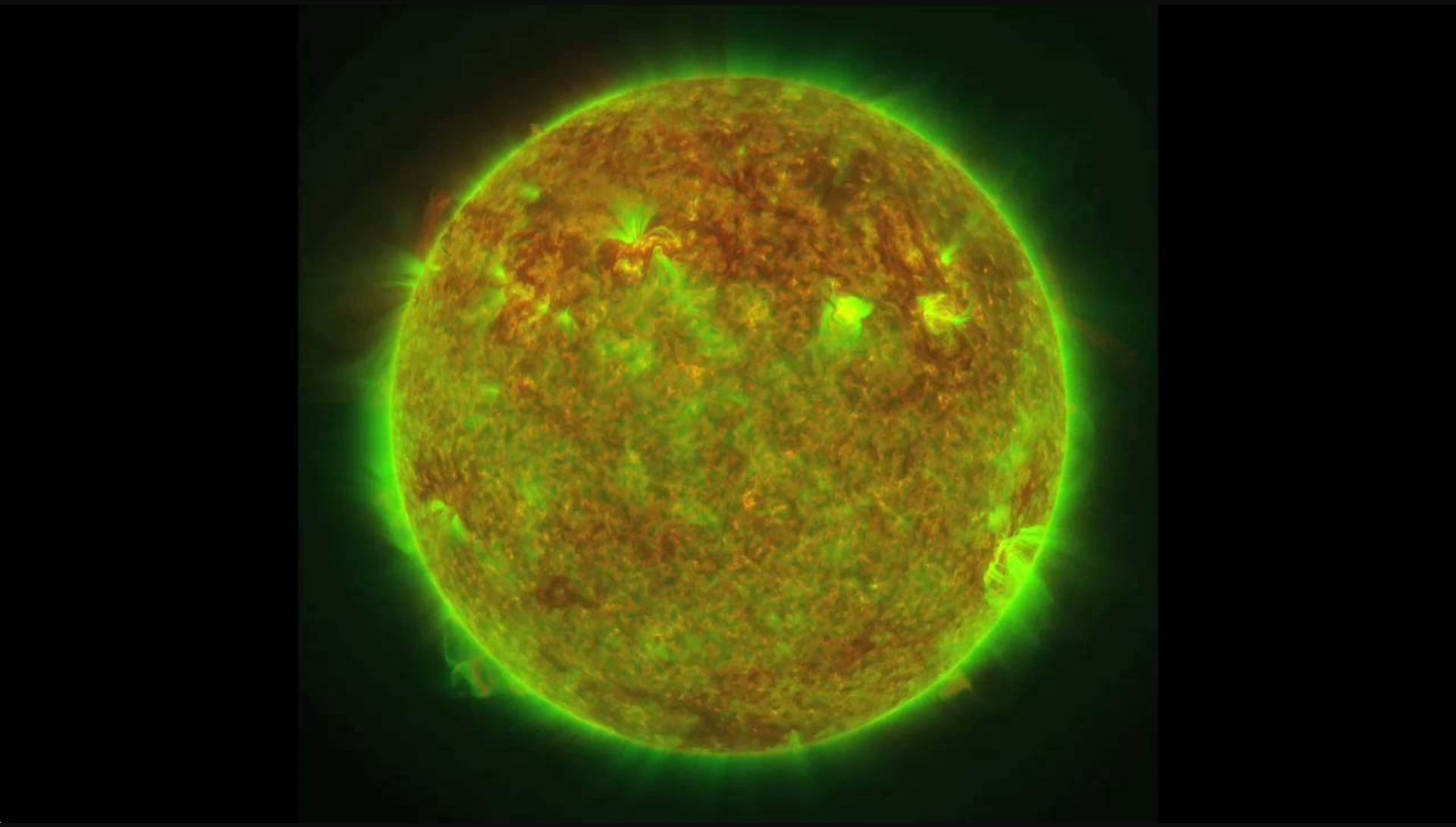

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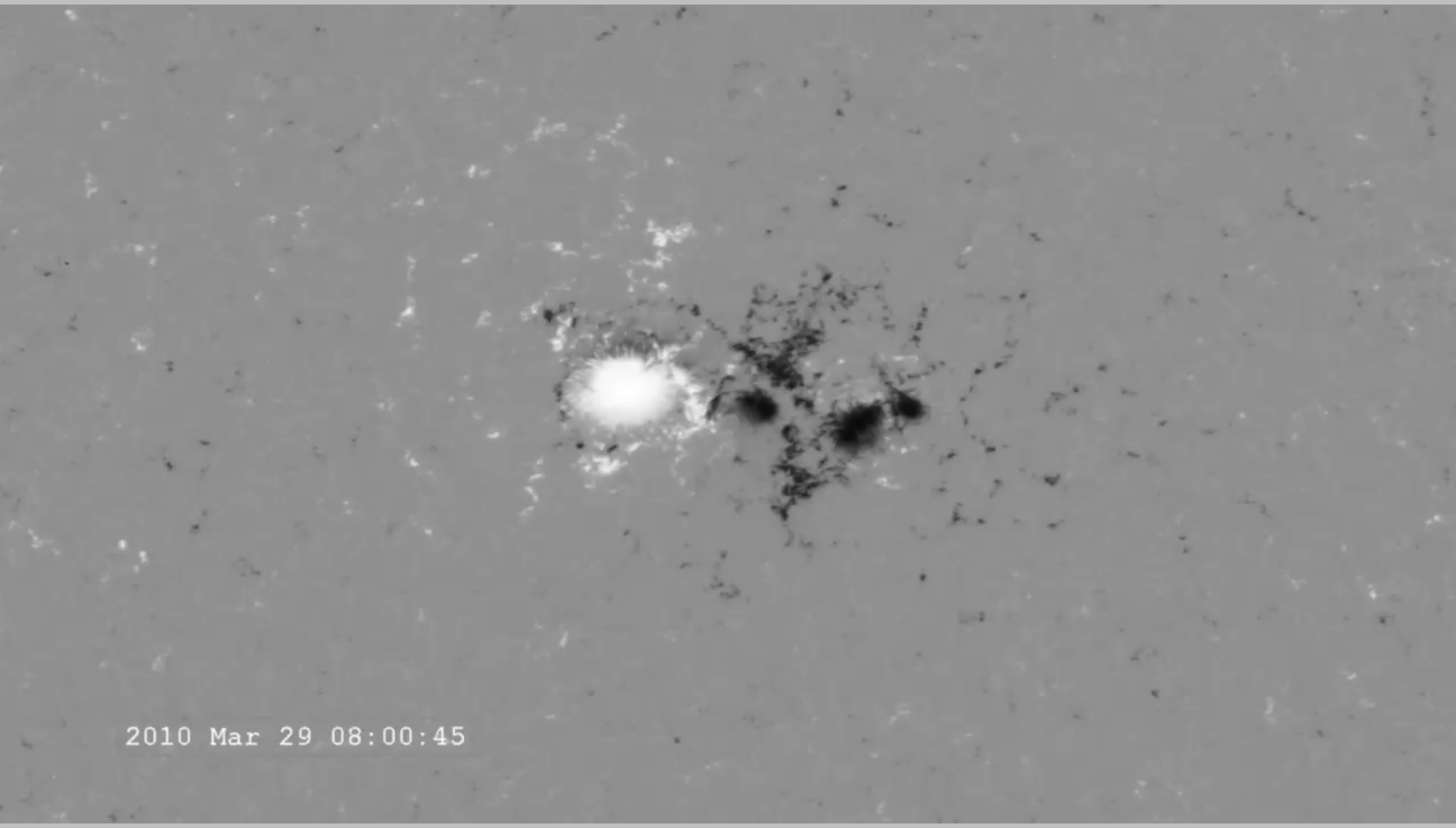

Doors Open / First Light

Summary

1. SDO will provide an enormous amount of information about the Sun.
2. The Science Investigation Teams are preparing to make the data available in fits, jpeg, and jpeg2000 formats. Fully-calibrated science data is delayed 36 hours while more rapid data is made available more quickly.
3. We are not yet ready to serve the data (Phase E has not yet begun), but will be soon.
4. Data access workshops will be held at AAS/SPD at the end of May.
5. We would like to thank Solar Cycle 24 for waiting for SDO.