

CuSPP+: an interplanetary CubeSat to study particle acceleration

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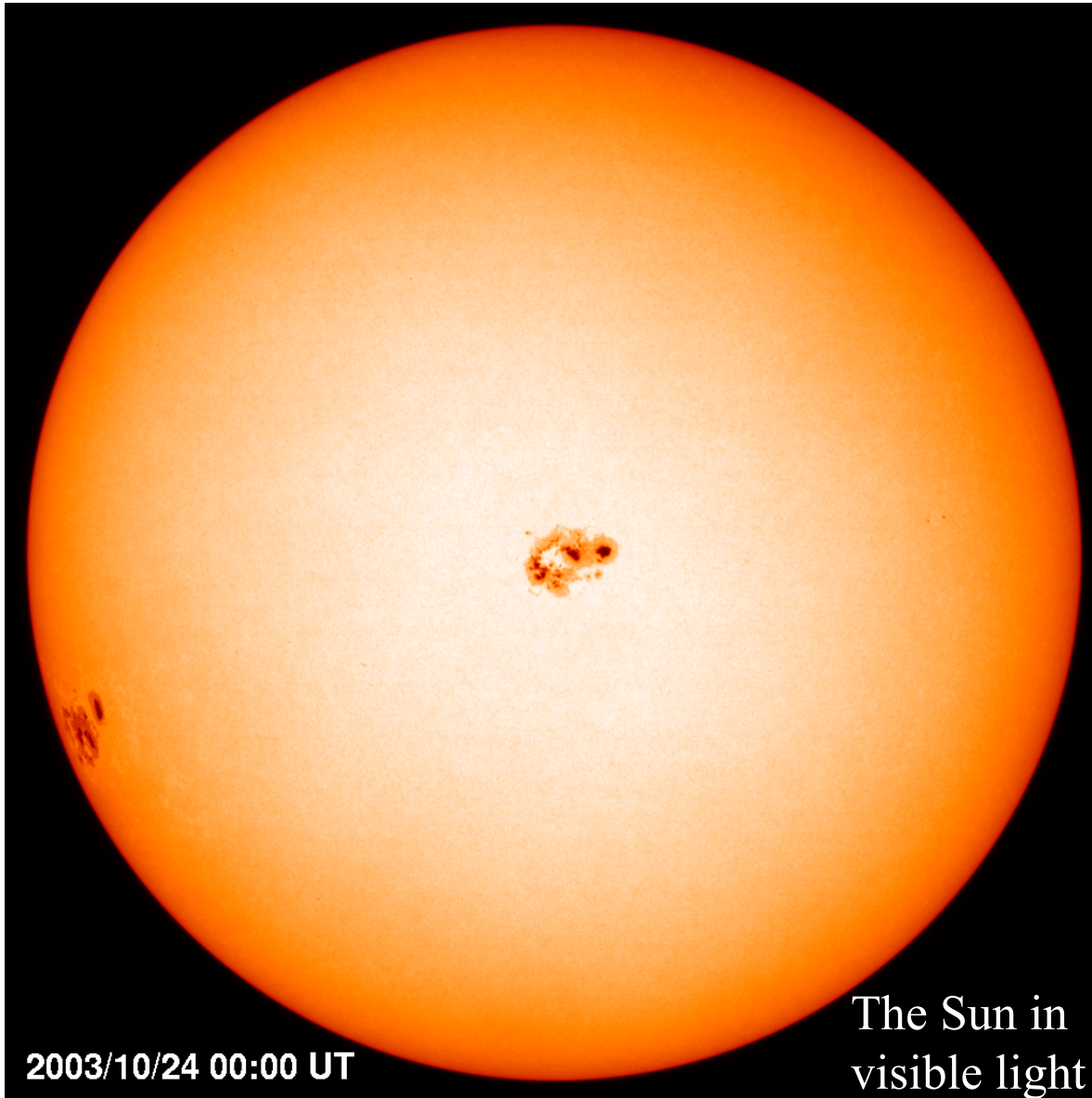
Southwest Research Institute, San Antonio

Dr. Neil Murphy

NASA/JPL, Pasadena



THE SUN



The Sun is a variable star.

That variability is driven by its magnetic field.

The Sun emits infrared, visible, UV, X-ray, and gamma ray photons (light), solar wind, solar energetic particles, and magnetic field.

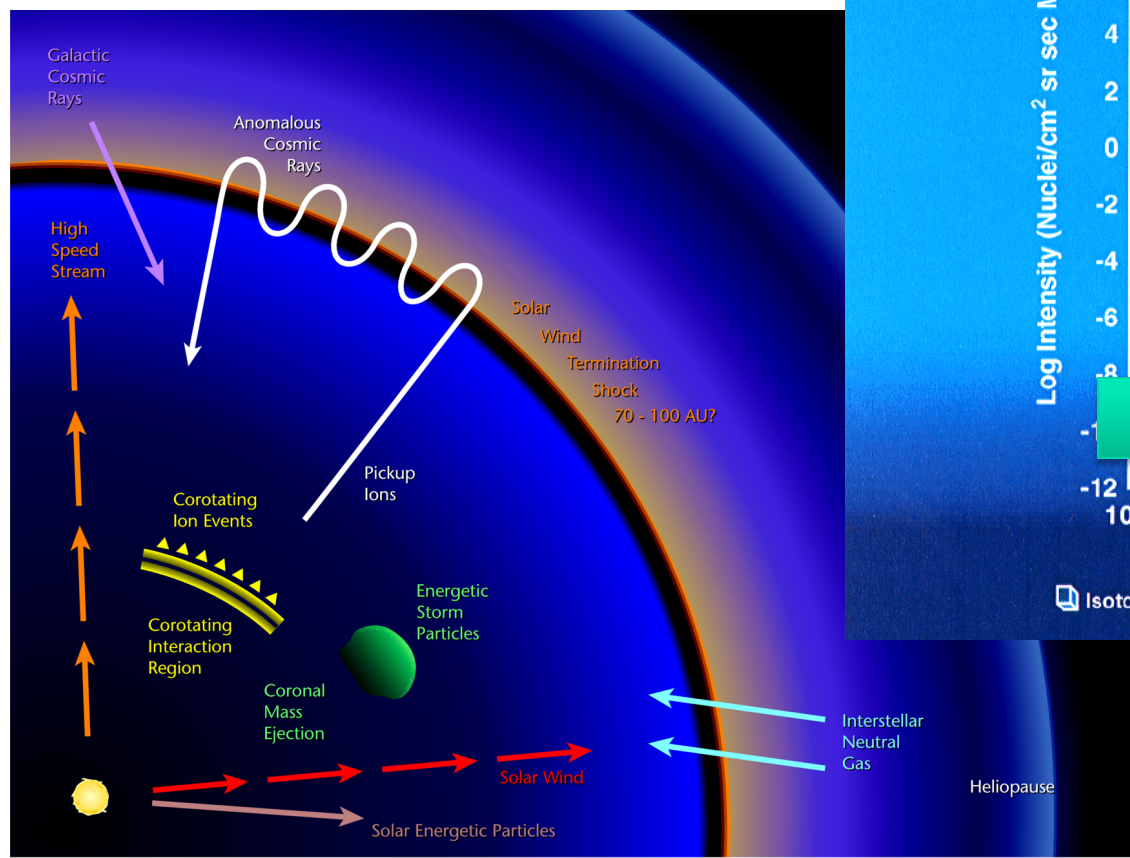
The output is variable for ALL of these components



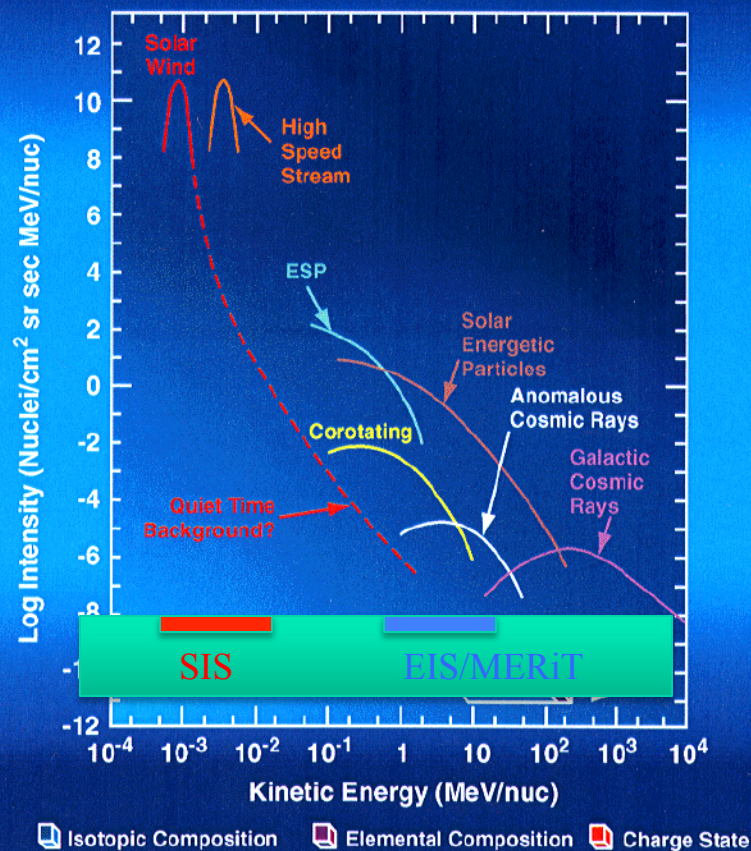
The Sun in
X-rays

The solar magnetic field defines the “heliosphere”. Particles of many flavors are present in varying amounts all through the heliosphere.

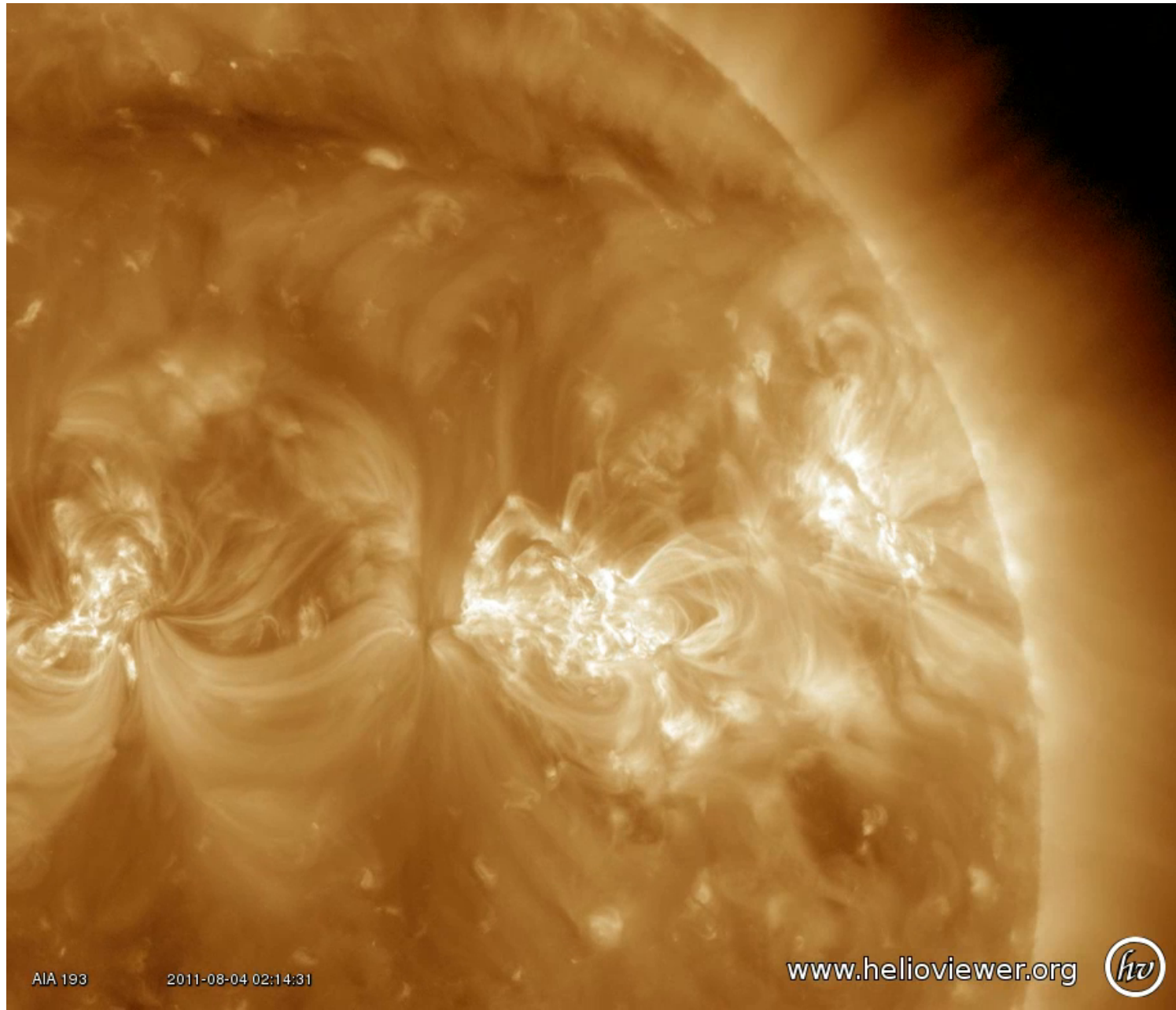
Many Types of Particles



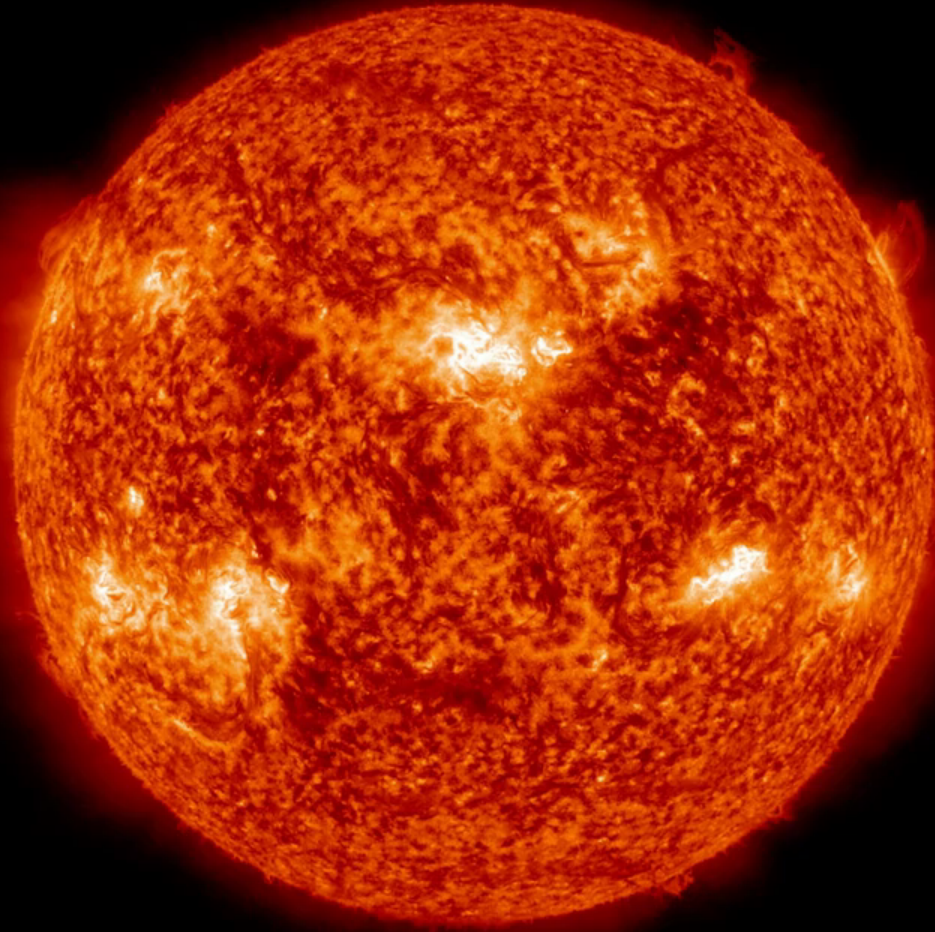
Spectra of Energetic Oxygen Nuclei



Solar Flares



Coronal Mass Ejections



SDO AIA

CUSPP

A CUBESAT MISSION TO STUDY SOLAR PARTICLES OVER
THE EARTH'S POLES

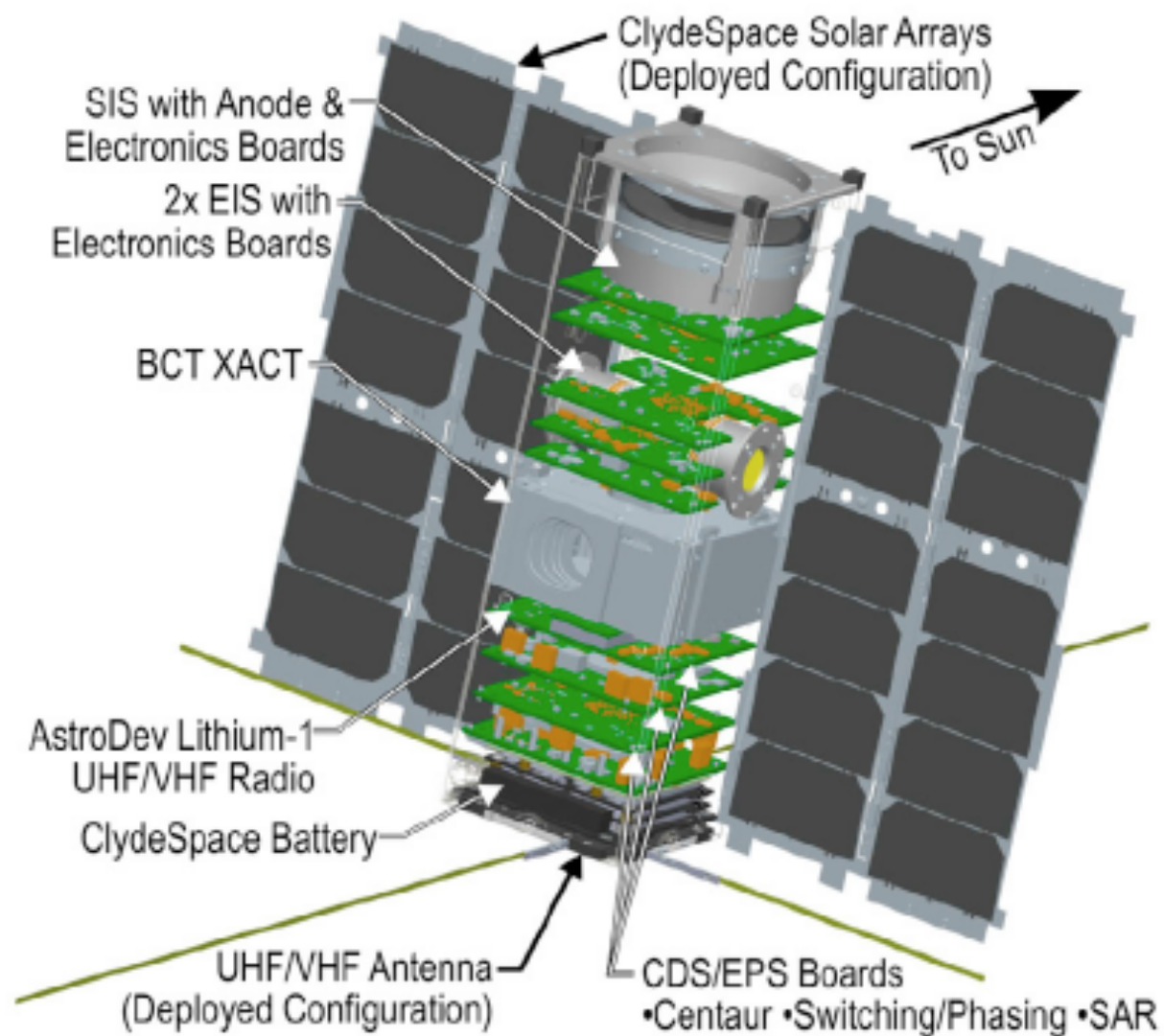
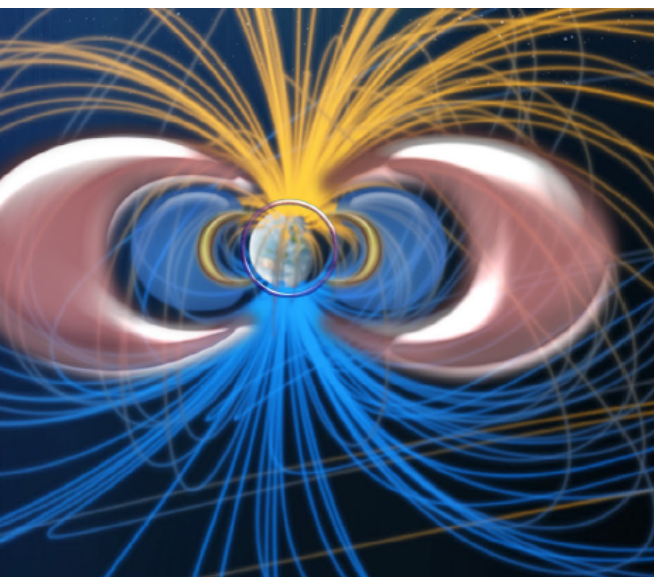


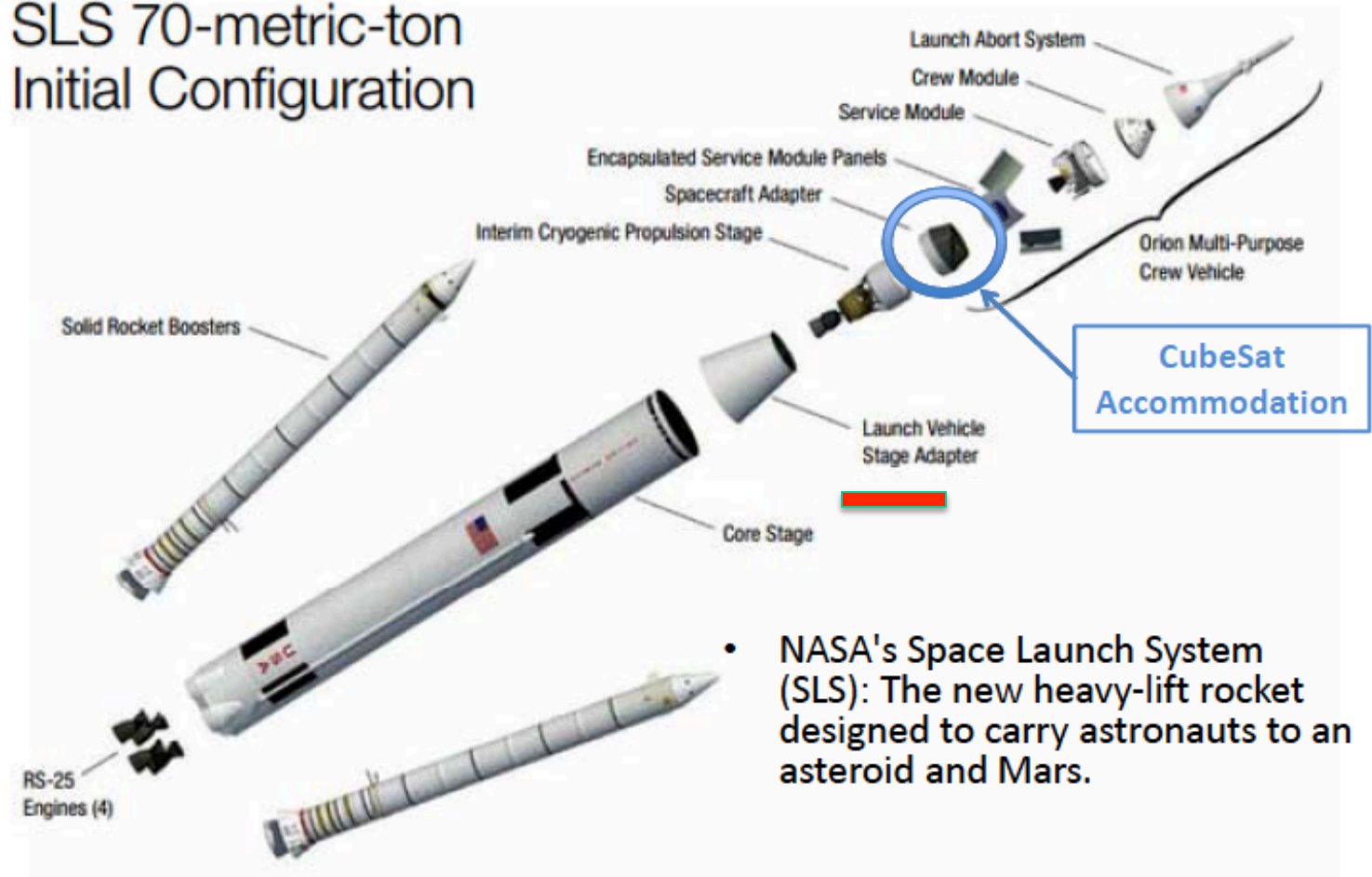
Figure 14. CuSPP mechanical layout.

NASA Heliophysics Division had an announcement for an interplanetary cubesat on the EM-1 (SLS) launch in 2018

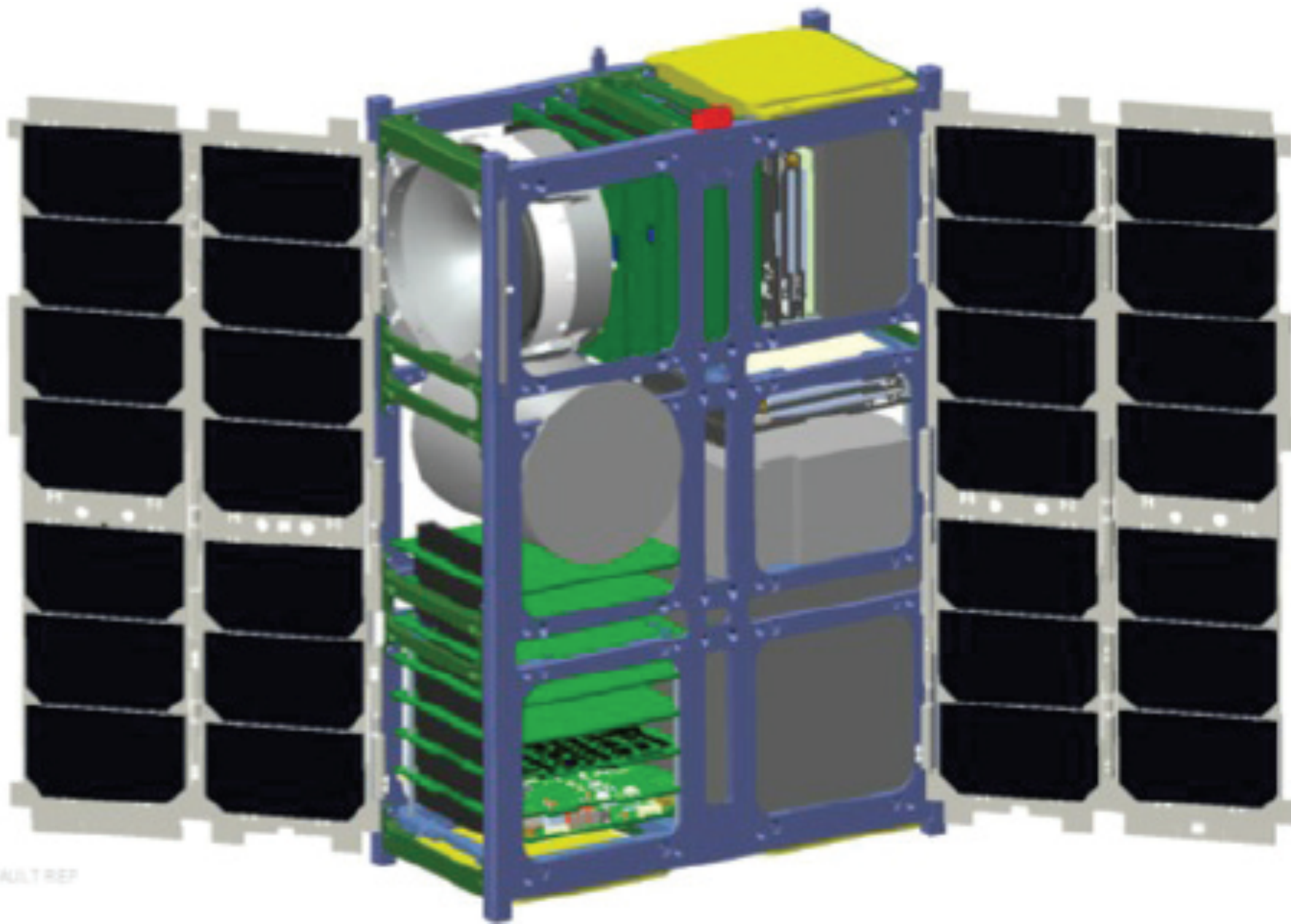
CubeSats as Secondaries on NASA's Space Launch System (SLS)

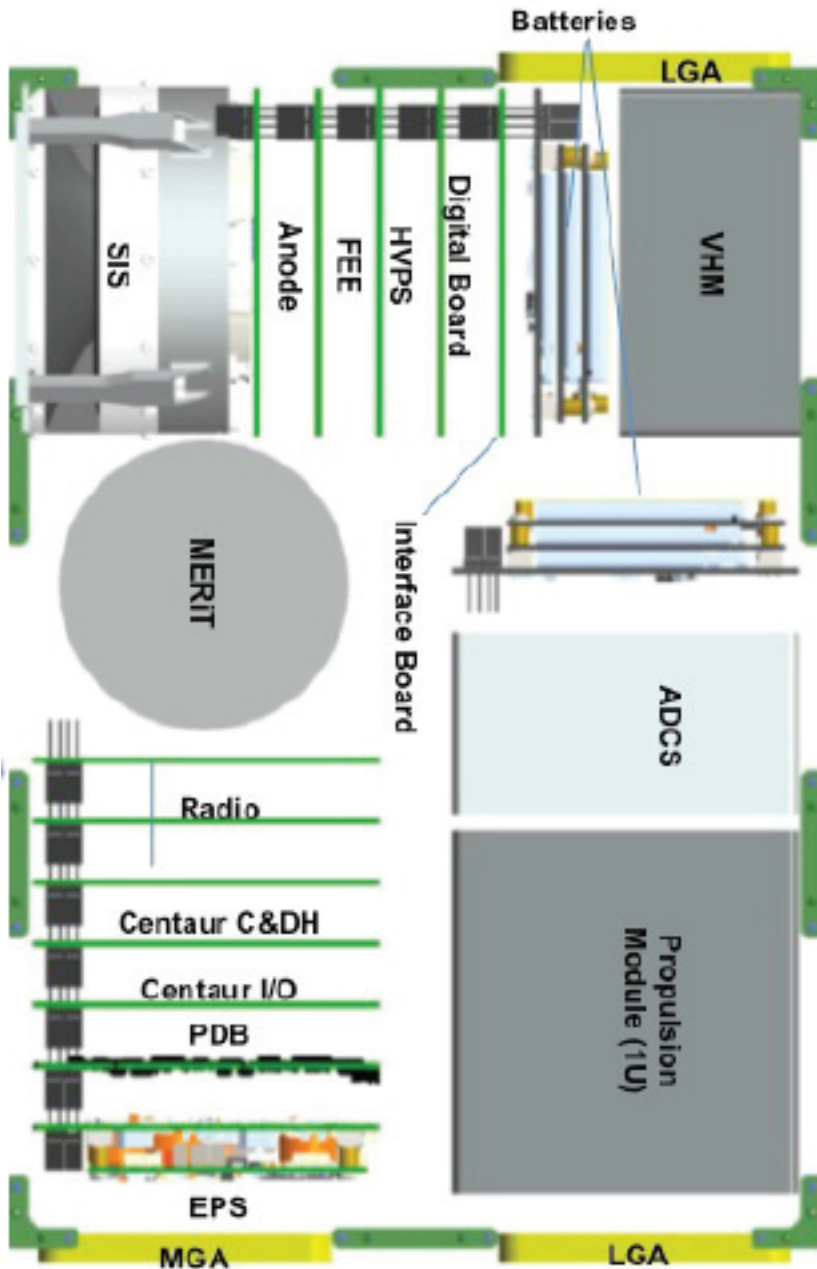


SLS 70-metric-ton Initial Configuration



- NASA's Space Launch System (SLS): The new heavy-lift rocket designed to carry astronauts to an asteroid and Mars.





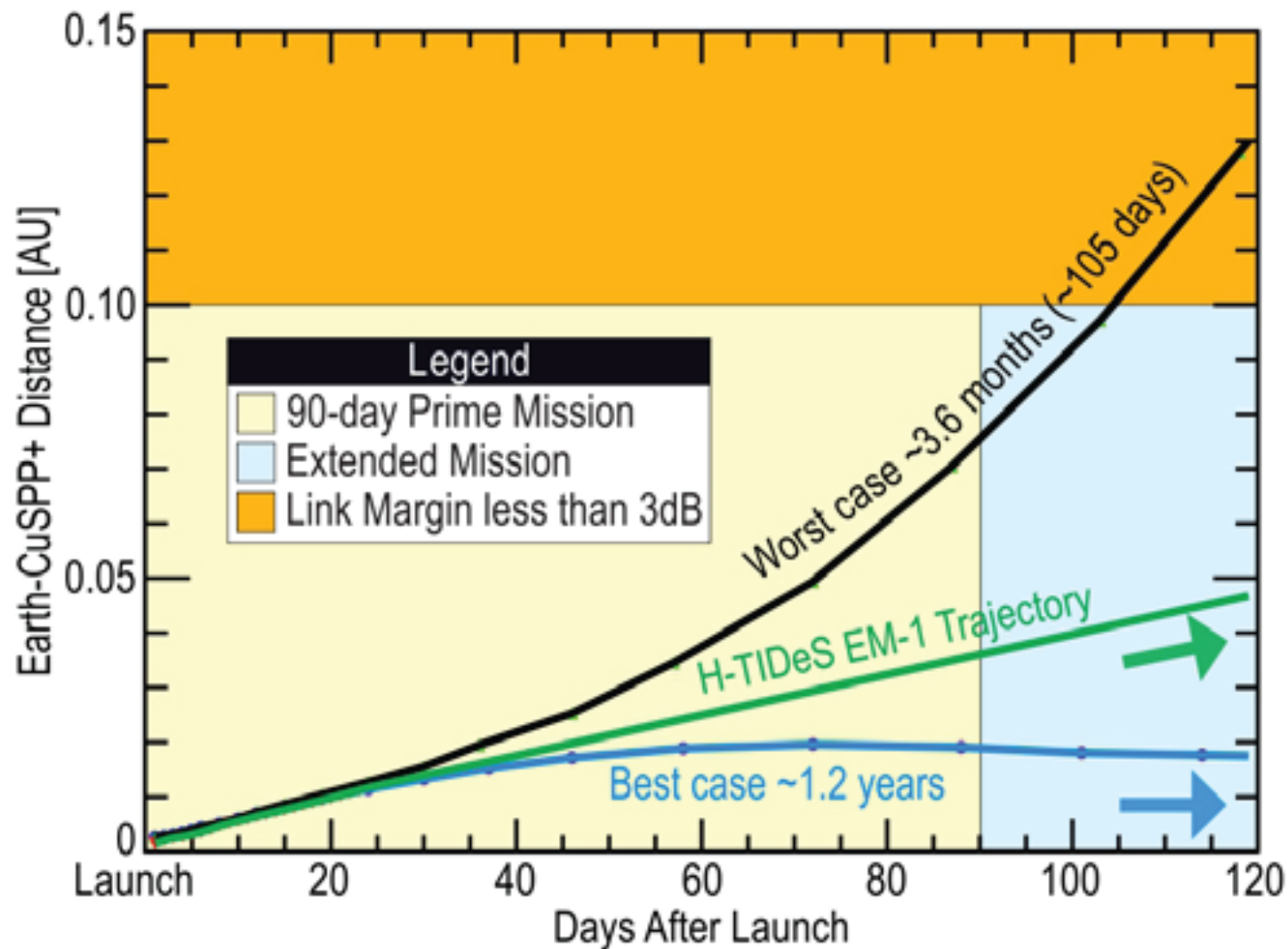
CuSPP is a 6U Interplanetary Cubesat with three instruments:

SIS: Suprathermal Ion Spectrograph (Southwest Research Institute)

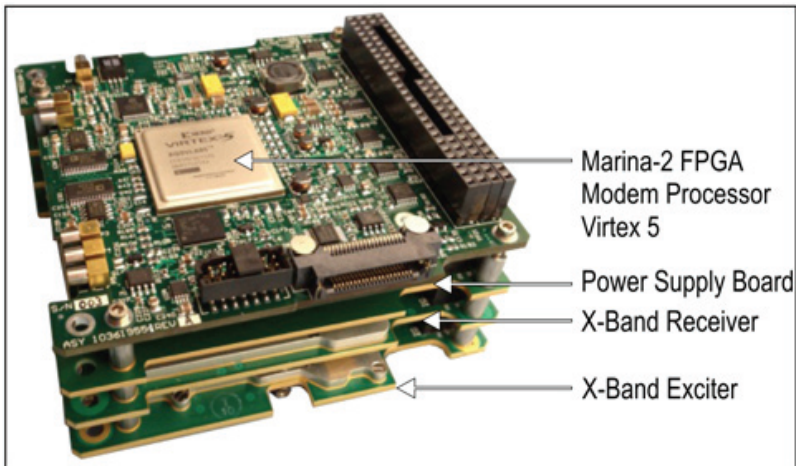
MERiT: Miniaturized Electron and Proton Telescope (NASA Goddard)

VHM: Vector Helium Magnetometer (Jet Propulsion Laboratory)

EM-1 orbit can get very far from Earth, very quickly

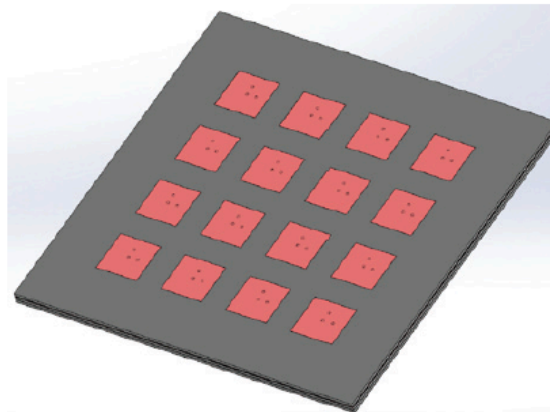
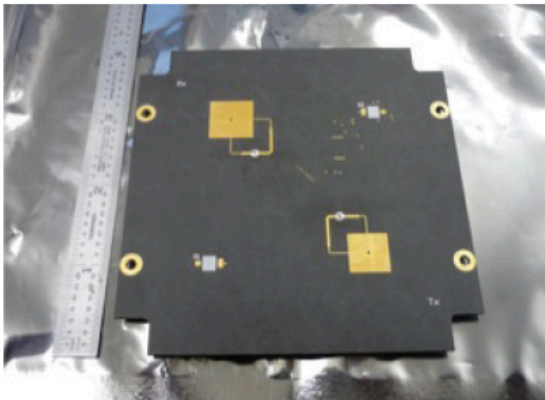


Top two proposals were told by NASA to do a six-week study to show that their communications scenario would work. CuSPP+ redesigned the telemetry system and showed that they could command the spacecraft and download all the data for the 3-month mission.



TA009500-Mihir

IRIS 2 Transponder from
the Jet Propulsion
Laboratory



Low gain (left)
and Medium gain
(right) antennas
for CuSPP+

Conclusion

- CuSPP+ can do excellent science, while also serving as a test bed for future Interplanetary Cubesats
- Submitted communications study in March 2015
- Waiting for selection results (1 in 2 chance)
- The Space Launch System will be an important step in the ability to launch Interplanetary Cubesats
- Communications is a key issue. The further from Earth you go, the harder it is to communicate within the power and size requirements of a cubesat