CuSPP+: an interplanetary CubeSat to study particle acceleration

Dr. Eric R. Christian
Research Scientist
Heliophysics Division
NASA Goddard Space Flight Center

Dr. Mihir Desai, Principal Investigator
Southwest Research Institute, San Antonio

Dr. Neil Murphy
NASA/JPL, Pasadena
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 solar magnetic field defines the “heliosphere”. Particles of many flavors are present in varying amounts all through the heliosphere.
Solar Flares
Coronal Mass Ejections
Figure 14. CuSPP mechanical layout.
NASA Heliophysics Division had an announcement for an interplanetary cubesat on the EM-1 (SLS) launch in 2018.

- 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.

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