Characterizing the evolution of radiation with the Cosmic Ray Telescope for the Effects of Radiation

J. Kasper (1), H. Spence (2), J. B. Blake (3), M. Golightly (4), L. Kepko (4), J. Mazur (3), T. Onsager (4), L. Townsend (5)

(1) Kavli Institute for Astrophysics and Space Research, Massachusetts Institute of Technology, USA, (2)Astronomy Department, Boston University, USA, (3)The Aerospace Corporation, USA, (4) Air Force Research Laboratory, Hanscom Air Force Base, USA, (5) Department of Nuclear Engineering, The University of Tennessee, Knoxville, USA (jck@mit.edu)

Great progress has been made in understanding the composition and sources of variation in the radiation environment of the inner heliosphere. A fundamental step in translating the primary spectrum of radiation into biological and hardware effects is understanding the evolution of the linear energy transfer (LET) of these particles as they pass through matter. At high energies, this process is complicated by uncertainties in our knowledge of nuclear fragmentation cross sections and in the limitations of modern propagation codes. We present the design of the Cosmic Ray Telescope for the Effects of Radiation, an instrument selected for flight on the Lunar Reconnaissance Orbiter (LRO) spacecraft. LRO is the first mission in the NASA Robotic Lunar Exploration Program and is planned for launch in late 2008. The overall mission objective is to prepare for and to support future human exploration of the moon. To achieve that objective, LRO includes investigations that will characterize the lunar radiation environment, develop a high-resolution geodetic grid of the lunar surface for selection of future landing sites, assess the resources and environments of the lunar poles, and map the surface composition. The operational orbit will be 50 ś 20 km altitude inclined at 90 degrees. The spacecraft will be 3-axis stabilized with a primary mission duration of 1 earth year. The CRaTER investigation will address the effects of ionizing energy loss in materials due to solar energetic particle events and galactic cosmic rays, specifically in silicon and in an analogue to human tissue. Our investigation focuses on understanding the linear energy transfer (LET) spectrum inside materials through direct measurement in the space radiation environment, particularly above 10 MeV/nucleon, combined with models of radiation transport through materials. The CRaTER results will have direct application to the biological and hardware effects of the lunar and inner heliospheric radiation environments.