Physical Research Laboratory, Ahmedabad

Colloquium 15-04

Speaker: **Prof. Daniel N. Baker**
Director, Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, USA & Vikram Professor, PRL.

Title: **"New Results Concerning Earth's Van Allen Radiation Belts"**

Time: **Wednesday, 18 February 2015, 16.00 hrs.**

Venue: **K. R. Ramanathan Auditorium, PRL**

Abstract

The first great scientific discovery of the Space Age was that the Earth is enshrouded in toroids, or "belts", of very high-energy magnetically trapped charged particles. Early observations of the radiation environment clearly indicated that the Van Allen belts could be delineated into an inner zone dominated by high-energy protons and an outer zone dominated by high-energy electrons. Subsequent studies showed that electrons in the energy range 100 keV < E< 1 MeV often populated both the inner and outer zones with a pronounced "slot" region relatively devoid of energetic electrons existing between them. This two-belt structure for the Van Allen moderate-energy electron component was explained as being due to strong interactions of electrons with electromagnetic waves just inside the cold plasma (plasma pause) boundary. The energy distribution, spatial extent and particle species makeup of the Van Allen belts has been subsequently explored by several space missions. However, recent observations by the NASA dual-spacecraft Van Allen Probes mission have revealed wholly unexpected properties of the radiation belts, especially at highly relativistic (E > 2 MeV) and ultra-relativistic (E > 5 MeV) kinetic energies. In this presentation we show using high spatial and temporal resolution data from the Relativistic Electron-Proton Telescope (REPT) experiment on board the Van Allen Probes that multiple belts can exist concurrently and that an exceedingly sharp inner boundary exists for ultra-relativistic electrons. Using additionally available Van Allen Probes data, we demonstrate that these remarkable features of energetic electrons are not due to a physical boundary within Earth's intrinsic magnetic field. Neither is it likely that human-generated electromagnetic transmitter wave fields might produce such effects. Rather, we conclude from these unique measurements that slow natural inward radial diffusion combined with weak, but persistent, wave-particle pitch angle scattering deep inside the Earth's magnetosphere can conspire to create an almost impenetrable barrier through which the most energetic Van Allen belt electrons cannot migrate.

The Speaker

Dr. Baker obtained his Ph.D. degree with James A. Van Allen at the University of Iowa. Following postdoctoral work at the California Institute of Technology, he joined the physics research staff at the Los Alamos National Laboratory (LANL), and became Leader of the Space Plasma Physics Group at LANL in 1981. His primary research interest is the study of plasma physical and energetic particle phenomena in planetary magnetospheres and in the Earth's vicinity. Dr. Baker has published over 800 papers in the refereed literature and has edited eight books on topics in space physics. He is a Fellow of the American Geophysical Union, the International Academy of Astronautics, and the American Association for the Advancement of Science (AAAS). He has won numerous awards for his research efforts and for his management activities including recognition by the Institute for Scientific Information as being "Highly Cited" in space science (2002), being awarded the Mindlin Foundation Lectureship at the University of Washington (2003) and being selected as a National Associate of the National Academy of Sciences (2004).

Tea at 15:30 hrs.

ALL ARE WELCOME