

Title: *Prompt Creation of New Radiation Belts*

Cluster: *Cross-Theme Theory and Data Analysis/SECTP*

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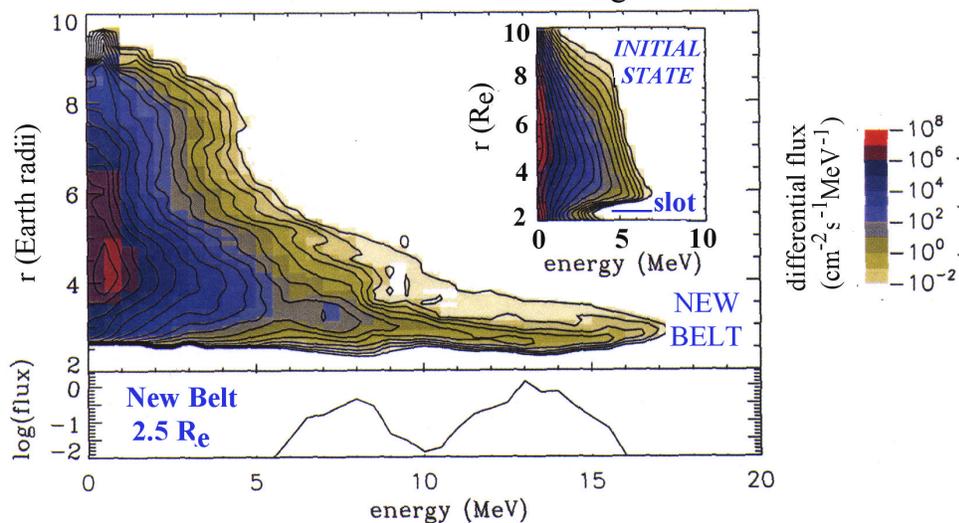
• **Radiation belt genesis via shock-induced magnetospheric compression**

The unexpected creation of new electron and proton radiation belts during the March 24, 1991 geomagnetic storm has challenged scientists to rethink the formation and stability of the Earth's radiation belts. The new belts appeared within minutes near the "slot region", between the inner and outer radiation belts, when an interplanetary shock rapidly compressed the Earth's magnetosphere (the largest compression on record). The newly formed belts persisted until 1994. With joint SECTP and ISTP support, a promising new technique for modeling radiation belt dynamics has been developed. It embeds a particle-pushing code for radiation belt particles in a global MHD simulation of the solar wind-magnetosphere interaction. Results for the 1991 storm show that an initial outer zone electron source population (approximated by NASA's average empirical radiation belt model AE8MIN) was transported radially inward by the shock-induced electric field to the sparsely populated slot region. This transport occurs in 1-2 minutes and reproduces the observed flux peak at 13 MeV for the 1991 event. A new proton belt also forms at the same location.

Understanding temporal changes in the radiation belts is a part of the Sun-Earth Connection Roadmap quest to understand how the Earth's and Planets respond to solar variations. The new research result is a significant advancement in understanding and predicting the impacts of the radiation belts on spacecraft systems and astronauts.

Model produces a new electron radiation belt in the slot region with peak energy fluxes as observed, at 13 MeV energy.

03:56 UT, Mar 24, 1991 Midnight



Elington, S. R., M. K. Hudson, M. J. Wiltberger and J. G. Lyon, MHD/particle simulation of radiation belt dynamics, *J. Atmos. Sol.-Terr Phys.*, **64**, 607-615, 2001.