Radial transport in energizing radiation belt electrons in the magnetosphere

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Because the actual electron population is ultimately the net result of a delicate balance among energization, transport, and loss, it has been very difficult to determine whether radial transport or in situ heating contributes more to the observed electron enhancements. Observations and models, however, do provide some insight into acceleration mechanisms. It is generally agreed that the creation of new radiation belts associated with a strong interplanetary shock impacting the magnetosphere can result in the fast inward radial transport of pre-existing particles from large L to form a new radiation belt. Test-particle tracings in fields generated by global MHD simulations show that energetic electrons can be transported from the magnetotail into the inner magnetosphere. Simultaneous observations at geosynchronous orbit and L=4.2 show that the phase space density is almost always higher and increases first at geosynchronous orbit, and then enhances at L=4.2. Long term predictions of MeV electrons at L=4 as well as L=6 based on the radial diffusion equation driven by solar wind parameters suggest that radial diffusion is the main acceleration mechanism because of the good match between the predicted and measured electrons at different L. This talk will review recent achievements in the understanding of inward radial transport as a means of energizing relativistic electrons in the Earth's magnetosphere.