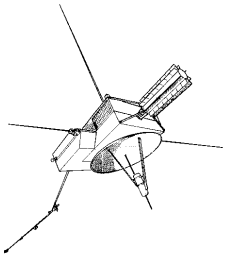
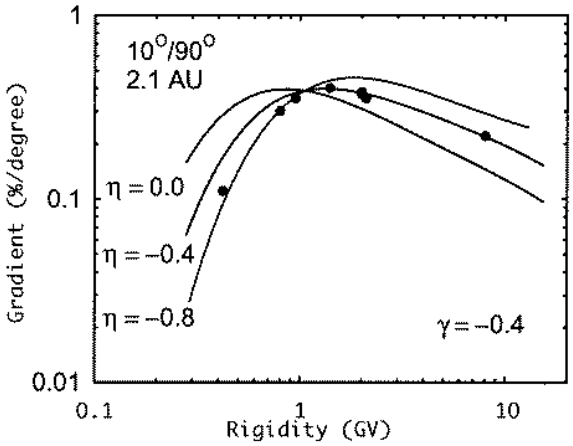
Rigidity dependence of cosmic ray proton latitudinal gradients





Rigidity dependence of the observed and modeled latitudinal gradients during the Ulysses 1994/95 fast latitude scan. The filled circles are the maximum values of the observed gradients. The solid lines are model fits with γ and η being parameters of the fit.

The latitudinal gradient of cosmic rays observed by Ulysses is small, and it increases as a function of rigidity (momentum/charge) up to 2 GV and then decreases. These gradients result from drift and diffusion of the cosmic rays. Reproducing these properties leads to information as to how the cosmic rays propagate (Burger et al., JGR, 105, 27447, 2000). First, the diffusion perpendicular to the magnetic field in the direction of the solar poles must have flatter rigidity dependence than the parallel diffusion. Second, there must be two distinct components of the perpendicular diffusion: one independent of rigidity, and one increasing as the square at low rigidity and becoming flat at high rigidity. This suggests that perpendicular diffusion is a superposition of resonant scattering by magnetic fluctuations and field line random walk. Observations by Ulysses during the coming A<0 solar magnetic polarity cycle will impose stricter constraints on interpretation than those obtained during the past A>0 cycle.