Geophysical Research Abstracts
Vol. 16, EGU2014-4090-1, 2014
EGU General Assembly 2014

The origin of Jupiter's outer radiation belt

Emma Woodfield (1), Richard Horne (1), Sarah Glauert (1), John Menietti (2), Yuri Shprits (3,4,5)

(1) British Antarctic Survey, Cambridge, United Kingdom (emmwoo@bas.ac.uk), (2) Department of Physics and Astronomy, University of Iowa, USA, (3) Skolkovo Institute of Science and Technology, Moscow, Russian Federation, (4) Massachusetts Institute of Technology, Cambridge, MA, USA, (5) University of California, Los Angeles, CA, USA

The intense inner radiation belt at Jupiter (>50 MeV at 1.5 R_J) is the result of adiabatic transport of electrons from further away from the planet; however, a seed population of high energy electrons is still required at between 6 and 10 R_J with energies that exceed 1 MeV. Here we test the hypothesis that the seed population outside the orbit of the moon Io could be formed from a very soft energy spectrum due to particle injection processes, and acceleration via whistler mode chorus waves. Using particle data as an initial condition at an energy of 20 keV, we use the BAS radiation belt model to calculate the change in the electron energy spectrum between 6.5 and 15 R_J due to whistler mode chorus waves. Simulations show that the resulting energy spectrum lies very close to the empirical Galileo Interim Radiation Electron model (GIRE) spectrum at Jupiter after less than one day at 100 keV and less than 10 days at 1 MeV, suggesting that the seed population could indeed be formed by wave-particle interactions. The results are insensitive to the softness of the initial energy spectrum but do critically depend on the value of the flux at the minimum energy boundary. Simulations for wave acceleration and radial diffusion together show that the resulting spectrum remains close to the GIRE spectrum but the radial profile of phase space density is smoothed.