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Electron Acceleration at Jupiter: Cyclotron-Resonant Interaction with Whistler-Mode Chorus Waves.

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It has been shown at the Earth that cyclotron-resonant interactions with whistler-mode waves are a major contribution to the acceleration of electrons to MeV energies in the radiation belts. Previous work has suggested that this mechanism is also viable at Jupiter up to a few MeV outside the orbit of Io. Here we re-examine the data used in previously published energy diffusion rates for Jupiter for Lshells from 6 to 18 and show that energy diffusion rates should be increased by up to a factor of 8 at Lshells greater than 10. We investigate the effect of the latitudinal distribution of chorus waves on the diffusion rates in both energy and pitch angle. We find that increasing the latitude to which constant power chorus waves extend from $\pm 10^{\circ}$ to $\pm 30^{\circ}$ increases energy diffusion rates by an order of magnitude or more but also increases the pitch angle diffusion dramatically such that many more electrons are scattered into the loss cone and lost. Using a profile of wave power versus latitude based on Galileo data we find that power increases away from the equator and then falls off rapidly beyond $\pm 10^{\circ}$. Consequently losses are reduced and much greater acceleration is predicted. Applying energy and pitch angle diffusion coefficients based on observed chorus wave power in the British Antarctic Survey Radiation Belt model we can rapidly increase the electron fluxes from a very soft energy spectrum to one close to that observed at Jupiter outside the orbit of Io (10 days for electron energies of approximately 3 MeV) without including radial diffusion.