Necessary conditions for relativistic resonant acceleration in the radiation belt

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We performed a test particle simulation where we assumed the dipole geomagnetic field (L=4) and a coherent whistler mode wave. We found that a relativistic resonant acceleration (RRA) of high energy electrons takes place as an irreversible process due to the resonant trapping by a coherent whistler-mode wave propagating away from the equator. Through a single resonant trapping process, the energetic electrons can be accelerated to the relativistic energy range of a few MeV. We report necessary conditions for RRA. In Figure we show the trajectory of energy increase. The resonant point of each run was h = 100, 500, 1000 and 1500, respectively. The variable h is a distance from the equator along the geomagnetic field. The increased electron energy is a few hundred KeV. We find that electrons are more accelerated, as the resonant point become further. The wave amplitude of each run was 10pT, 40pT, 70pT and 100pT, respectively. The larger amplitude is necessary for RRA, as the distance h becomes larger.