

Limitation of energetic ring current ion spectra

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We address the problem of determining the limiting energetic ring current ion spectrum resulting from electromagnetic ion cyclotron (EMIC)-wave-ion-interactions. We solve the problem in a relativistic regime, incorporating a cold background multi-ion plasma component and without assuming a predetermined form for the energy distribution. The limiting spectrum is determined by the condition that the EMIC waves acquire a specified gain over a given convective length scale for all frequencies over which wave growth occurs. We find that the limiting ion spectrum satisfies an integral equation that must be solved numerically. However, at large particle energy E , the limiting spectrum takes the simple form $J \sim 1/E$. Moreover, this $1/E$ spectral shape does not depend on the energetic ion in question nor on the background multi-ion plasma composition. We provide numerical solutions for the limiting spectra for Earth-like parameters. In addition, at Earth and four other planets we compare measured ion spectra with corresponding numerical limiting spectra.

Keywords: ring current ion spectra, EMIC waves, limiting ion spectrum