

## Energetic ring current proton spectra measured by the Van Allen Probes

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We examine two geomagnetic storm periods, namely March 17-20, 2013 and March 17-20, 2015, and analyze proton spectra measured by the Radiation Belt Storm Probes Ion Composition Experiment (RBSPICE) on board the Van Allen Probes. In particular, we consider the most intense proton spectra over the energy range 50 - 600 keV, for outer-zone L-shells, during these storm periods. Recent theory has been developed to model the limitation of energetic ring current ion spectra resulting from the action of pitch-angle scattering by electromagnetic ion cyclotron (EMIC) waves. The theory suggests that a limiting (extreme) spectrum is achieved when the EMIC waves acquire a certain gain over a given convective length scale for all frequencies over which wave growth occurs. We obtain the theoretical limiting spectrum numerically, and also show that the limiting spectrum varies as  $1/E$  for large kinetic energy  $E$ . Comparison of the observed extreme proton spectra with the corresponding numerical limiting spectra provides evidence that the extreme spectra are controlled by EMIC wave scattering.

Keywords: ring current protons, extreme proton spectra, Van Allen Probes