

Cold ions perpendicularly heated by fast magnetosonic waves in the inner magnetosphere observed by Arase (ERG) satellite

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Fast magnetosonic (MS) waves are commonly observed in the equatorial region of the inner magnetosphere. Past numerical simulations show MS waves can accelerate cold ions through cyclotron resonance, although the observational evidence is still unclear. Arase (ERG) satellite found events of perpendicular heating of cold ions simultaneously with plasma wave activities of the MS waves. We found more than 200 events of the perpendicular heating of low-energy (10eV/q - a few keV/q) ions in a period between April 2017 to June 2018, and 70% of them coincide with the MS waves. These heated ions are distributed to all the MLT regions within magnetic latitude of +/-10deg, which is consistent with the region where the MS waves frequently observed.

We have applied the WPIA (wave-particle interaction analysis) method to the selected ion heating event with the MS waves. The results show that the MS waves accelerate the ions with pitch angles near 90 degrees. Moreover, we found these ions give their energy to EMIC waves which appears just below the local proton cyclotron frequency. Since MS waves are considered to be generated by the ring distribution of ions, this analysis indicates energy transfer from higher-energy ions to the cold ions in the inner magnetosphere.

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