Ultra-relativistic electron's pitch angle distribution narrowing associated with the solar wind density enhancement

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Electron pitch angle distribution (PAD) is a critical parameter in the study of the dynamics of the radiation belt electrons. It is well known that solar wind pressure has an impact on the PAD of the geomagnetically trapped electrons. Using the Van Allen Probes’ data, we find that the MeV electron PAD at 4.5<L*<5.5 became narrowing (PAD is mainly concentrated at 90 degree) for over three days during a prolonged enhancement of the solar wind number density on November 27-30, 2015. During that period, the EMIC waves are observed by Van Allen Probe-A and ground stations on the afternoon and dusk MLTs at L>4. Meanwhile, the precipitations of tens of keV protons and MeV electrons are observed by POES satellites. Additionally, there is a growing dip in electron phase space density at L*~5, indicating a local loss caused by the wave-particle interaction. The narrowing of the electron PAD is energy-dependent and the PAD is more anisotropic for electrons with higher energy, which is consistent with the wave-particle interaction with the EMIC waves. Furthermore, previous studies have shown that high solar wind density can lead to a hot and dense plasma sheet. The inward penetration of a dense plasma-sheet down to 4 Re has been confirmed by THEMIS spacecraft. We suggest that the overlap of the plasma sheet and the plasmasphere provide a favorable condition for exciting EMIC waves and the loss of small pitch angle electrons by EMIC waves can lead to the electron PAD narrowing.