URSI GASS 2021, Rome, Italy, 28 August - 4 September 2021

Driver of Jupiter's Diffuse Aurora: Comparison Between Juno Observations and Theoretical Calculations

Wen Li* [1], Qianli Ma [1, 2], Xiaochen Shen[1], Xiaojia Zhang[2], and Juno team
(1) Boston University, Boston, Massachusetts, 02215, e-mail: luckymoon761@gmail.com
(2) University of California, Los Angeles, 90095.

Recent Juno observations indicate that Jupiter's diffuse aurora, which occurs in an extensive region equatorward of the main oval, is generated by precipitating energetic electrons over a broad energy range. Although previous studies suggested whistler mode waves as a potential driver of Jupiter's diffuse aurora, their quantitative contribution to generate the diffuse aurora at Jupiter remains unclear. In this study, using the combined wave data from Juno and Galileo, we construct a new global map of whistler mode waves in the Jovian inner magnetosphere (M-shell < 20) and found that whistler mode waves are extensively present over M-shells from 6 to 13 and extend to magnetic latitudes at least up to 50°. The newly constructed whistler mode wave properties on a global scale are used to perform an in-depth analysis of an intriguing diffuse aurora event during Perijove 23 using coordinated observations of precipitating electrons observed by JEDI and JADE, whistler mode waves measured by Waves, and diffuse aurora detected by UVS. We use quasilinear theory to quantify energetic electron precipitation driven by whistler mode waves and found that the calculated electron energy flux and characteristic energy of precipitating electrons are consistent with the JEDI measurements over ~30–1000 keV, while additional mechanisms are needed to explain the observed electron precipitation by JADE at lower energies (0.1–30 keV). Our result provides new quantitative evidence that whistler mode waves are a primary driver of precipitating > ~30 keV electrons through pitch angle scattering at M-shells over 8–15, and thus generate Jupiter's diffuse aurora.