Van Allen Probes Observations of Modulation of Energetic Ion Fluxes by a Fundamental Poloidal Mode Standing Alfvén Wave

*Kazue Takahashi[1], Seth Claudepierre[2], Craig Kletzing [3], Charles W Smith [4]

1. The Johns Hopkins University Applied Physics Laboratory, USA, 2. The Aerospace Corporation, USA, 3. Department of Physics and Astronomy, University of Iowa, USA, 4. Physics Department and Space Science Center, University of New Hampshire, USA

Magnetospheric ULF waves are known to cause periodic modulations of the flux of ring current ions (energy range ~10-300 keV). Many previous studies reported ion flux modulation events associated with second harmonic poloidal mode standing Alfvén waves. In this study, we report Van Allen Probes observations of an ion flux modulation event associated with a fundamental poloidal wave. The wave (period ~ 100s) was observed on 6 October 2012 in the prenoon and produced a giant pulsation on the ground. The standing wave mode was unambiguously determined from the relationship between the electric and magnetic field perturbations at the spacecraft. The field oscillations were accompanied by oscillations of the flux of ions over an energy range of 100-200 keV. Contrary to previously reported similar ULF wave events with strong modulation of equatorial protons, the flux oscillations in the present event were strongest at pitch angles around 30 degrees. The amplitude and phase of the ion flux oscillations exhibited signatures of drift resonance at 150 keV, from which the wave is inferred to be propagating westward with an azimuthal wave number of 35. This wave number is consistent with the ion finite Larmor radius effects seen in ion fluxes measured at different phases of the spacecraft spin. The ion phase space density exhibits a radial gradient that is consistent with theoretical prediction of an instability involving drift resonance of ring current ions with fundamental poloidal waves.

Keywords: Fundamental standing Alfvén wave, Van Allen Probes, Ring current ions

