Electron anisotropy driven by kinetic Alfven waves in the Earth magnetotail

Alexander Lukin\textsuperscript{1,2}, Anton Artemyev\textsuperscript{1,3}, Evgeny Panov\textsuperscript{4}, Anatoly Petrukovich\textsuperscript{1}, and Rumi Nakamura\textsuperscript{4}

\textsuperscript{1}Space Research Institute of Russian Academy of Sciences, Moscow, Russian Federation (as.lukin.phys@gmail.com)
\textsuperscript{2}Faculty of Physics, National Research University Higher School of Economics, Moscow, Russian Federation
\textsuperscript{3}Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA, USA
\textsuperscript{4}Space Research Institute of Austrian Academy of Sciences, Graz, Austria

Thermal and subthermal electron populations in the Earth’s magnetotail is usually characterized by pronounced field-aligned anisotropy that contributes to generation of strong electric currents within the magnetotail current sheet. Formation of this anisotropy requires electron field-aligned acceleration, and thus likely involves field-aligned electric fields. Such fields can be carried by various electromagnetic waves generated by fast plasma flows interacting with ambient magnetotail plasma. In this presentation we consider one of the most intense observed wave emissions, kinetic Alfven waves, that accompany all fast plasma flows in the magnetotail.

Using two tail seasons (2018, 2019) of MMS observations we have collected statistics of 80 fast plasma flows (or BBF) events with distinctive enhancement of intensity of broadband electromagnetic waves sharing properties of kinetic Alfven waves. We show that a direct correlation the intensity of electric fields of kinetic Alfven waves and electron anisotropy distribution: the parallel electron anisotropy significantly increases with magnitude of the wave parallel electric field. The energy range of this electron anisotropic population is well within the range of resonant energies for observed kinetic Alfven waves. Our results show that kinetic Alfven waves can significantly contribute to shaping the magnetotail electron population.