EGU21-990, updated on 11 Aug 2022
https://doi.org/10.5194/egusphere-egu21-990
EGU General Assembly 2021
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Slow electrostatic solitary waves in the Earth's magnetosphere

Sergey Kamaletdinov[1,2], Ivan Vasko[1,3], Egor Yushkov[1,2], Anton Artemyev[1,4], and Rachel Wang[3,5]

[1]Space Research Institute, Space plasma department, Moscow, Russian Federation (serjesmail@gmail.com)
[2]Faculty of Physics, Lomonosov Moscow State University, Moscow, Russian Federation
[3]Space Science Laboratory, University of California, Berkeley, California, USA
[4]University of California, Los Angeles, California, USA
[5]Department of Physics, University of California, Berkeley, California, USA

Slow electron holes, that are electrostatic solitary waves propagating with velocities comparable to the ion thermal velocity, can contribute to plasma heating and provide an anomalous resistivity in various space plasma systems. In addition, the analysis of electron holes allows revealing instabilities operating on time scales not resolved by plasma instruments. We present experimental analysis of more than 100 slow electron holes in the Earth's bow shock and more than 1000 slow electron holes in the Earth's nightside magnetosphere. We show that in both regions, the electron holes have similar parameters. The spatial scales are in the range from 1 to 10 Debye lengths, amplitudes of the electrostatic potential are typically below 0.1 of local electron temperature, velocities in the plasma rest frame are of the order of local ion-acoustic velocity. We show that in both regions the electron holes are most likely produced by Buneman-type instabilities. We develop theoretical models of the electron holes and compare them to MMS observations. The lifetime and the transverse instability of the electron holes are discussed.

This work was supported by the Russian Scientific Foundation, Project No. 19–12-00313