Geophysical Research Abstracts
Vol. 19, EGU2017-1260, 2017
EGU General Assembly 2017

Protons and heavy ions acceleration by electromagnetic fluctuations in the Earth's magnetotail

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Energetic protons and heavy ions are very often observed in the Earth's magnetotail, as shown by numerous spacecraft observations. Yet the acceleration mechanism causing such energization is still under debate. One important candidate is the acceleration by electromagnetic fields fluctuations, which are also very often observed in the magnetotail. Here we perform test particle simulations in which protons and heavier ions are injected in three-dimensional time-dependent stochastic electromagnetic perturbations superposed to an unperturbed magnetic field configuration. We study the energization process for H+, He++ and O+ ions by performing a detailed analysis of particle dynamics. We find that light ions are preferentially energized and that the level of fluctuations affects the energization rate. We also compare the results from the model with MMS spacecraft observations.