

## ***Interactive comment on “Acceleration of protons and heavy ions to suprathermal energies during dipolarizations in the near-Earth magnetotail” by Andrei Yu. Malykhin et al.***

### **Anonymous Referee #1**

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Report on the manuscript "Acceleration of protons and heavy ions to suprathermal energies during dipolarizations in the near-Earth magnetotail" by Malykhin et al.

This manuscript reports a detailed study of ion acceleration in the near-Earth magnetotail, considering both protons, singly charged helium and singly charged oxygen. Ion acceleration is studied during complex dipolarization events with data obtained by Cluster spacecraft. Both the flux increases and the change in spectral index are considered in order to assess the acceleration of the different ion species. It is found that the flux increases start simultaneously for all species, but they last longer for heavier ions. Also, the change of spectral index, i.e. a decrease in the exponent  $\gamma$

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which implies a hardening of the spectrum, is larger for helium and even larger for oxygen. It is also found that oxygen ions are those which reach the highest energies in the considered dataset.

The manuscript is clear and well written, the figures support the conclusions of the text, and I read it with interest. It is appropriate for publication on Ann. Geophysicae, but I suggest the authors to strengthen the physical interpretation by considering the following specific comments.

1. What is the reason for the longer duration of the decrease of  $\gamma$  with growing mass? Time of flight?
2. Is heavy ion acceleration mass proportional? From Figure 7 one would say almost, but not exactly. Can you discuss this proportionality? Knowing this would help to constrain the acceleration mechanisms.
3. Have you considered the possibility that multiply charged oxygen ions could influence the measurements?
4. Page 3, line 23: I wonder whether a minus sign should be somewhere in the expression of  $\gamma$ .
5. Page 4, line 40: "but was observed longer" perhaps would be better "was observed for a longer period"
6. Page 5, lines 25-26: the sentence "The fact that the fluxes of different ion components behave in a similar way suggests that their dynamics can be related to the contraction of magnetic flux tubes during dipolarization" seems to be not related to the rest. Do you mean betatron acceleration? The physical meaning is not clear, and apparently in contrast with the indications of nonadiabatic ion acceleration.

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