Annales Geophysicae Discussions

Ann. Geophys. Discuss., author comment AC2
https://doi.org/10.5194/angeo-2020-89-AC2, 2021


# Reply on RC2

Andrei Runov et al.

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Author comment on "Ion distribution functions in magnetotail reconnection: global hybrid-Vlasov simulation results" by Andrei Runov et al., Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2020-89-AC2, 2021

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We thank the Reviewer for careful reading and valuable comments.

Speiser orbits are particular orbits in magnetotail like fields with finite Bz that consist of quasi-adiabatic gyro motions outside the neutral sheet, turning into a meandering motion when the particle enters the central current sheet (together with an approximate half-gyration around the finite Bz), and become gyromotions again when the particle exits toward higher latitude on the same or the opposite side. It is not clear whether the author refer to such motion or just to the meandering part, which is an indication of non-adiabaticity. While distributions, such as in Fig. 6, are an indication of non-gyrotropy, it is not clear how they would indicate specifically Speiser type orbits.

**Reply**

We thank the Reviewer for a great question. In our study, we placed virtual detectors close to the equatorial plane (Bx=0). Therefore, we observe the meandering part of the Speiser trajectory. Particles there experience an acceleration in the dawn-to-dusk electric field that leads to an asymmetry in the phase space density (vy>0), that are visible in Figure 6 m, n, and o. Similar distributions were observed in simulations and observations and were attributed to the Speiser-type meandering motion (e.g., Nagai et al., 2015, doi:10.1002/2014JA020737; Hietala et al., 2015, doi:10.1002/2015GL065168). We interpreted the half-ring distributions in Fig. 6 m, n, and o as signatures of the meandering motion. We will add necessary explanations to the text.

Page 2, line 11: The original term used by Liu et al is “dipolarizing” flux bundle, as is used also later in the paper. One might, however, argue that “dipolarizing” implies “increasing Bz,” which probably was not intended by Liu and I would not object to leaving this as is.

**Reply**

Point taken. An increase in Bz is one of the criteria which were used by Liu et al (2013) to define ``dipolarazing flux bundles'' (DFB). Yet, one should distinguish DFBs, which are transient magnetic structures, and ``dipolarizations'', i.e., gradual, temporal increase in Bz. We will add the necessary clarification in the revised manuscript.

Page 3, line 24: The previous sentence refers to Fermi acceleration, causing the field-aligned beams. Simply change: “This” to “The” and a bit later eliminate “thus.” Also, the

two effects are the same: adiabatic convection toward increasing B is, in the moving frame, the betatron effect.

**Reply**

We thank the Reviewer for the valuable suggestion.

Page 5, line 25: Shouldn't this be a "cylinder" rather than a "sphere"?

**Reply**

Indeed, strictly speaking, the 2D geometry and the usage of a line dipole make it more exact to refer to the inner boundary as a perfectly conducting cylinder than a sphere. We will make the correction in the revised manuscript. Thank you!