

Interactive comment on “Resolution dependence of magnetosheath waves in global hybrid-Vlasov simulations” by Maxime Dubart et al.

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We thank the reviewer for their examination of our manuscript and their comments. Please find below our response to your concerns.

"The authors have written an article about a long-standing problem of whether mirror modes or ion cyclotron waves should dominate in the Earth's magnetosheath. This topic has a long history and there have been many papers (which were not referenced) on this topic. However more importantly, there have been some recent works that appear to have solved the problem. These papers unfortunately supercede the work that you have done. I therefore cannot accept your work to AG in anything resembling

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the present version. [...] The authors should also cite some of the earlier papers quoted in the 2009 and 2013 papers that address the issue of MM/EMIC growth rates. This will give more context to your work."

We thank the reviewer for pointing out the lacking connections to previous work about the question of mirror mode versus ion cyclotron waves in the magnetosheath and for providing valuable references about this topic. We would like to emphasise that the intention of this paper is primarily to help future global hybrid-Vlasov simulations to save resources when simulating and investigating magnetosheath waves, and secondarily to investigate the mirror mode waves and the ion cyclotron waves in term of those resolutions, not the competition between these modes. We will add the suggested references in the revised manuscript and revise the manuscript in terms of the physics the reviewer suggested. We will also add more clarity and emphasis to the primary focus of the paper.

"These earlier papers state that the growth rate of the ion cyclotron wave is higher than the MM waves, contrary to your results. You will need to reconcile this point as well."

Fig. 6 of our manuscript shows the growth rate of the proton cyclotron (Panel a) and mirror (Panel b) instabilities at the three different resolutions: 300 km (blue), 600 km (red), 900 km (orange). As can be seen, the proton cyclotron growth rate is higher than the mirror growth rate in all resolutions, consistent with the previous works mentioned by the reviewer.

"The second sentence in the abstract may be incorrect. Please note that there are electron cyclotron waves in the magnetosheath called lion roars."

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We will emphasise in the revised manuscript that we focus on ion-scale waves.

"MM waves have also been detected at Jupiter's and Saturn's magnetosheaths as well. There are many references to this, including the original 1982 paper. Line 30: See introduction of 2011 JGR paper for more references to MM detection in interplanetary space (solar wind), in the Earth's geotail, and at comets. MMs have also been detected at heliopause. These references should be included. Line 255. I suggest that you add more references to some of the earlier work that focused on the issue of the growth of the two competing modes. This was mentioned earlier."

Thank you very much for pointing this out. We will gladly provide more references about the detection of these waves in these other setups.

Interactive comment on Ann. Geophys. Discuss., <https://doi.org/10.5194/angeo-2020-24>, 2020.