

Review report, Volwerk et al., ‘Statistical distribution of mirror mode-like structures in the magnetosheaths of unmagnetised planets: 2. Venus as observed by the Venus Express spacecraft’

This paper reports on Venus Express magnetic field measurements of magnetic mirror mode waves in the magnetosheath of Venus. While this is a very interesting subject, unfortunately I have to recommend that this paper be rejected. I have two reasons for this:

1) There are actually very few new results in the paper. Almost all results are simply confirmations of earlier results reported by the first author [Volwerk et al., 2008a; 2008b; 2016]. In this manuscript, the whole Venus Express database is used for a statistical study. This of course has some value, but in my opinion does not in itself warrant a new publication. The authors indicate that they will use these data for a manuscript in which these results will be compared to similar data from Mars. This promises to be an interesting paper, and I would recommend to simply absorb the method and data from this manuscript into that paper.

2) Parts of the paper are rather poorly written, in particular the Introduction. There are also several misprints and mistakes that indicate that the manuscript has been put together in some haste.

Below I give some more detailed motivation for my recommendation.

Introduction:

The major flaw of the introduction is that it totally ignores on mentioning the work that has been already performed by the main author on this subject. That gives a somewhat misleading impression that the work presented in this paper is new and original, instead of putting it in context of earlier work. Comparison of earlier work only appears late in the paper (from line 265.)

lines 32, 40, 55, 58, (and also 311, 336, 352): The authors talk about ‘*temperature asymmetry*’, while in reality they should be discussing temperature *anisotropy*.

line 35: a version of the magnetic mirror (MM) mode for multiple species is given (Equation 1). How is this relevant for this paper? What are the species to be used apart from protons? Cold electrons? Oxygen ions?

line 43: Here another form of an instability criterion is used, while discussing ion cyclotron waves. Why is the criterion given in this form? It is actually the same criterion as Eq. 1 for a single species, which is easily verified by a few lines of algebra. What is the relevance of giving this equation?

Results:

As mentioned, most results in this paper are simply confirmations of earlier results. Specifically:

Figure 2: Here even the same example as in [Volwerk et al., 2008a, 2008b, 2016] is used. Some new data would be in place here.

Figures 6-8: These are very similar to Figure 4 of [Volwerk et al., 2008b], and Figure 3 of [Volwerk et al., 2016].

Figure 11: Simply a reproduction of [Volwerk et al; 2016] (as the authors mention themselves.)

Figure 12: Very similar to Figure 4 of [Volwerk et al; 2016].

Figure 13: There is not much additional information as compared to Figures 5 and 6 of [Volwerk et al., 2016].

line 248-249: The conclusions here are the same as in the earlier work.

General issues. These are just some examples of the paper not having been carefully prepared. I stopped taking notes at some point.

line 46: '*B strength*'. Too informal.

line 47: '*conservation of first adiabatic invariant*'. Grammar.

line 47: '*The first process...*' This sentence discusses on of the processes responsible for creating a temperature anisotropy. Then the discussion ends abruptly with no further discussion of the other processes that are mentioned. Is is unclear what the authors want to say.

line 72: '*the dats*' ?

line 86: '*the data B*' What is meant by this?

line 97: '*to which the reader is referred to*' Grammar.

line 101: R_V not defined.

line 114: '*refsec:detection*' ?

line 137: What is the CSW method?

line 265: '*Comparison with Volwerk et al.*' Not correct reference format.

line 278: '*The probability for both solar conditions is the same for solar minimum and maximum*' Unintelligible sentence.

References

Volwerk, M., Zhang, T. L., Delva, M., Vörös, Z., Baumjohann, W., and Glassmeier, K.-H.: First identification of mirror mode waves in Venus' magnetosheath?, *Geophys. Res. Lett.*, 35, L12204, <https://doi.org/10.1029/2008GL033621>, 2008a.

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