Posudek na doktorskou disertační práci

Nonlinear processes in space plasmas and their effects on the generation and propagation of electromagnetic waves

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The thesis deals with properties of the chorus electromagnetic emission in the Earth's inner magnetosphere. It is based on two first-author papers in the peer-reviewed international Journal of Geophysical Research:

- The first paper (Hanzelka et al 2020) applies the phenomenological model of the chorus nonlinear evolution of Omura to formulate a simple model for the formation of packet substructure of the observed chorus. The model is numerically solved and its results are compatible with in situ observations by the Van Allen Probes spacecraft.

- The second paper (Hanzelka et al 2021) analyzes the impact of the modelled chorus emissions on electrons using the test-particle approach. These results are then used to asses observability of the chorus imprints on the electron distribution function.

The thesis contains a lot of information, has textbook-like sections on waves and wave-particle interactions, presents a critical review of the Omura nonlinear chorus model, as well as a review of other models of chorus emissions. It also describes the results obtained in the two papers and discusses them. In contrast with the high scientific content, the thesis is not well organized. The presented information is not logically well-orderded and is hard to follow.

The main part of a thesis should be a comprehensible description of the new results obtained by the author. This part (sections 4 and 5) is not very comprehensible and, in many respects, it is easier to read the two papers rather than the description of the corresponding work in the thesis. For instance, the description of the work in section 4 (Hanzelka et al 2020) heavily depends on section 3 so that the model description is full of cross references to section 3 and is very hard to follow. Similarly, section 5 (Hanzelka et al 2021) would be more accessible if the model description of particle trapping in a whistler wave would be there and not in section 2.

I have some questions and comments:

1. Why the whistler instability does not exhibit a quasi-linear evolution?

2. The radiation invoked in the model to trigger the formation of next wave packet (Fig. 4.1 or Fig. 1 in Hanzelka et al 2020) is well explained in the thesis. Is it possible that the next wave packed is generated at about the same position after some relaxation?

3. The presented model tends to generate wave packets with increasing frequency – how often is it observed?

4. The presented model also predicts wave packets propagating towards the equator – how often is it observed?

In concluding, the scientific content of the thesis and the two papers it is based on clearly demonstrate the author’s ability of independent scientific work. I recommend it for the defense.

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