

Interactive comment on “Excitation of chorus with small wave normal angles due to BPA mechanism into density ducts” by Peter A. Bespalov and Olga N. Savina

Anonymous Referee #2

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General comments

The authors study the chorus excitation in the density ducts in the frame of the beam pulse amplifier mechanism for the enhanced and depleted ducts. It is noted that the considered model allows one to explain small angles of the wave normal in the assumption of a single planar whistler-mode wave in a cold homogeneous plasma. The subject of the paper is significant for geoscience. The paper can be published after minor revision.

Specific comments

1) Page 2, line 9. It is written: ‘In the duct, a standing wave structure occurs at the
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transverse coordinate.’ It is not clear what the authors mean.

2) The main terms and concepts used in the paper could be explained more explicitly in the Introduction.

3) Page 3, lines 2-4. It is written that ‘the WKB approximation is fulfilled’. It is better to remind the conditions for the WKB approximation validity in more detail.

4) Figure 1 is not very illustrative. Two branches are hard to see, they should be marked. There is a lot of empty place in this figure. Modification is needed.

5) Page 3, line 13. It is written: ‘Let us note that there is a range of values k_z , ω in which k_x has not one, but two values.’ It is desirable to determine this region (or regions), if this point is essential.

6) Page 3, line 18. ‘(Laird, 1992)’ should be replaced by ‘(Laird, 1992)’.

7) Page 4, line 5. It is written: ‘While performing calculations, we will consider that the magnetic field is uniform and the electronic cyclotron frequency $\omega_B = 6 \cdot 10^4 \text{ s}^{-1}$. The plasma density outside the duct corresponds to the condition $(\omega_{p,\text{out}}/\omega_B)^2 = 25$. Inside the enhanced duct we have $(\omega_{p,\text{int}}/\omega_B)^2 = 29$, while inside the depleted duct, $(\omega_{p,\text{int}}/\omega_B)^2 = 21$.’ It is desirable to explain, why these values are chosen.

8) Figure 2. Labels ‘a’ and ‘b’ are not shown in figure. In the figure caption nothing is told about the red curves, the corresponding explanation is given only in the text. First and seventh ducted modes, probably, correspond to $p=1$ and $p=7$, respectively, which is desirable to note in the figure caption.

9) At the end of page 4 the normal angle is estimated. Why normal angle is only considered to be small? What will be in the opposite case? Some explanation is desirable. If it is determined by observations, for example, it should be mentioned.

10) There are no explanations of all designations in Eqs. (6) - (9). For example, what is V_z in Eq. (8)? There is reference to paper Bespalov and Savina (2018), however, for self-consistency it is desirable to describe all mentioned parameters.

11) Page 7, line 21. Instead of '(7)' it should be 'Eq. (7)'.

12) The new contribution related to the previous works should be emphasized more clearly.

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