Letter to the editor

Dear editor,

Thank you very much for the efficient work on the manuscript entitled “The dynamic of ion Bernstein–Greene–Kruskal holes in plasmas with regularized κ-distributed electrons” (npg-2023-25). We have revised the manuscript according to the Referees' comments. The detailed description of the revisions made in the paper is included in the response. For more clearly reading, the highlighted manuscript where all the revises are marked with yellow is also delivered. We appreciate for your warm work earnestly, and hope our revisions are acceptable. If you have any queries, please don’t hesitate to contact us.

Thank you again.
Yours sincerely,
Qiuping Lu, Caiping Wu, Hui Chen, Xiaochang Chen and Sanqiu Liu

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Reply to Referees

Dear Referee,

Deeply thanks to you for your constructive and very helpful comments. Our manuscript has been revised according to your comments, and the point-by-point replies for your comments are as follows. Detailed revises are marked with yellow in the revised version of manuscript. We appreciate for your warm work earnestly, and hope that the correction will meet with approval.

Thank you again for your comments and suggestions

Sincerely,
Qiuping Lu, Caiping Wu, Hui Chen, Xiaochang Chen and Sanqiu Liu.

Point-by-point replies to the referee 2’s comments as follows,

Question 1: Although the paper title and abstract are about “The dynamic of ion Bernstein-Greene-Kruskal holes”, this paper does not consider any dynamical properties and entirely focuses on construction of the stationary solutions of ion holes. There are multiple such solutions already published for different plasma distributions, and all these solutions may be important only in context of comparison with observations or investigation of hole dynamics and stability analysis. It’s quite hard, if

possible, to justify construction of 1D electrostatic equilibrium without any analysis of applicability of this equilibrium to some realistic (observed in space or laboratory) structures. Therefore, the motivation for this study, and importance of obtained results are unclear.

Reply: We are very grateful for your valuable suggestions.
Firstly, if permitted by editorial office, we would like to change the title to make it more relevant to the content, according to your suggestion.
Secondly, the manuscript focuses on the space structure of ion holes, trapped ion distribution function-energy ($f_{\mathrm{tr}} - w$), and width-amplitude ($\delta - \psi$) relation. The effects of the cut-off parameter α and spectral index κ_{e} on the depth and energy of ion holes, and the allowed combination of width and amplitude to support physically plausible ion holes equilibrium are studied. The cut-off parameter α and spectral index κ_{e} affect the number of superthermal electrons, which in turn affects the energy conversion between trapped ions and superthermal electrons and has an impact on the depth of ion holes and allowed combination of width and amplitude to support physically plausible ion holes equilibrium.

Thirdly, as for your comment of "There are multiple such solutions already published for different plasma distributions, and all these solutions may be important only in context of comparison with observations or investigation of hole dynamics and stability analysis. It's quite hard, if possible, to justify construction of 1D electrostatic equilibrium without any analysis of applicability of this equilibrium to some realistic (observed in space or laboratory) structures. Therefore, the motivation for this study, and importance of obtained results are unclear.", we fully agree with you that all these solutions may be important only when compared to observations or when studying hole dynamics and stability analysis and it's quite hard to justify construction of 1D electrostatic equilibrium without any analysis of applicability of this equilibrium to some realistic (observed in space or laboratory) structures. We are sorry that, at the moment, we have not found a concrete example of an observation and specific instances in space plasma environments where this condition is observed, but I hope that this study will provide a theoretical reference for the results of observing such a situation in space plasma, astrophysical plasma and laboratory.

Question 2: Figures 2, 3 show absolutely identical structures that are different only by color bars…

Reply: Thank you for your comments. We need to apologize for not expressing it clearly. Figure 2 denotes the phase space structure of the trapped ion distribution function $f_{\mathrm{tr}}(x,v)$ in $x-v$ space for different κ_{e} at $\alpha = 0.01$, $\delta = 0.2$ and

$\psi = 2$. While figure 3 represents the phase space structure of the trapped ion distribution function $f_{\mathrm{tr}}(x,v)$ in $x-v$ space for different κ_{e} at $\alpha = 0.2$, $\delta = 0.2$ and $\psi = 2$. The color bars in both figures 2 and 3 represent the depth of ion holes. It can be seen that when α increases, the IHs becomes deeper for a fixed potential and κ_{e}. When κ_{e} increases, the IHs becomes deeper for a fixed potential and α.

Question 3: Section 2 ends by Eq. (18), whereas Section 3 starts with "…BGK holes are examined by analyzing Eqs. (19) and (20)." I did not find these equations in the text…

Reply: Thank you so much for your careful works and we sincerely apologize for our carelessness. We have modified it in revised manuscript.
i.e.: In this section, the plasma parameters related to ion BGK holes are examined by analyzing Eqs. (17) and (18). (Page 6 line 1)

The detailed description of the revisions made in the paper is included in the response. For more clearly reading, the highlighted manuscript where all the revises are marked with yellow color is also delivered.

All detail revises, please see the revised manuscript (the PDF file) where all the revises are marked with yellow color. We appreciate for Editors/Reviewers' warm work earnestly, and hope that the revisions will meet with approval.
Once again, we highly appreciate for your time and consideration.

Sincerely,

Qiuping Lu, Caiping Wu, Hui Chen, Xiaochang Chen and Sanqiu Liu
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