The manuscript ***"Study of Temperature Anisotropy and Kappa Distribution Impacts on EMIC Waves in Multi-Species Magnetized Plasma"*** by us. The goal is to respectfully address all concerns and emphasize the novelty and improvements made, aiming for acceptance

Response to Referee # 1 Comments

Reviewer Comment: *The reviewer would like to thank the authors again for explaining that the nonlinear effects will be part of future research. However, rather than just mentioning it as a future research plan, referring to the expected nonlinear effects when using the Kappa distribution will improve the results of this study focusing on the linear growth. Therefore, I recommend that the authors include a discussion on the anticipated nonlinear effects.*

Response: We thank the reviewer for this constructive and insightful suggestion. In response, we have included a brief discussion in the revised manuscript under the *Summary of Results and Discussion* section regarding the potential nonlinear effects associated with the Kappa distribution. Although the present study primarily addresses linear wave growth, it is well established that suprathermal particle populations (characterized by low kappa values) can play a significant role in nonlinear wave–particle dynamics. These effects include enhanced wave trapping, resonant broadening, modulational instability, and saturation phenomena, all of which can alter the temporal evolution of wave amplitudes and the mechanisms of energy exchange.

In particular, nonlinear effects in kappa-distributed plasmas are expected to produce longer-lasting wave activity due to slower saturation and stronger resonance overlap. This could result in **more sustained particle scattering and heating**, especially in environments such as the auroral acceleration region. We have now added a concise paragraph discussing these expectations at the end of the *Results and Discussion* section.

We hope this addition meets the reviewer's recommendation and provides greater context for interpreting the linear results in connection with future nonlinear modelling.

Response to Referee # 2 Comments

We sincerely thank the reviewer for the thorough evaluation and helpful suggestions that have improved the quality of our manuscript. Below we provide a point-by-point response to each comment.

1. Line 96 – "Where the following conditions apply ...." can be removed

Response: As per the reviewer's suggestion, we have removed the phrase "Where the following conditions apply …" from line 96 to improve the clarity and readability of the manuscript.

2. Line 99–101 – Please correct the sentences

Response: Thank you for pointing this out. The sentences in lines 99–101 have been revised for grammatical accuracy and clarity. The revised version reads:

"The resonance condition plays a crucial role in determining the wave-particle interaction mechanism, especially under the influence of non-Maxwellian distribution functions such as the Kappa distribution, which represents the suprathermal particle population in space plasmas."

3. Line 168 – Capitalize "EMIC"

Response: "emic" in line 168 has been corrected to "EMIC" to maintain consistency and proper capitalization of the acronym throughout the manuscript.

4. Minor spelling mistakes and editing errors, like above, still exist throughout the manuscript

Response: We have carefully re-checked the entire manuscript for minor spelling mistakes, grammatical inconsistencies, and formatting errors. Necessary corrections have been made to ensure high editorial quality and consistency in terminology (e.g., EMIC, kappa distribution, wave growth, etc.).

5. The reviewer still believes that Growth rate v/s frequency graphs can be added (at least as Supporting Information), which will better identify what frequencies below the cyclotron frequency are growing or what bands of EMIC are unstable

Response: We sincerely thank the reviewer for this insightful suggestion. We fully agree that growth rate versus frequency plots is valuable for identifying unstable EMIC wave bands below the ion cyclotron frequencies. However, in the present study, we have chosen to present **growth rate versus parallel wave vector** to focus on the **spatial scales of instability** and to emphasize the **resonant interactions** central to our analysis involving **multi-ion plasmas with kappa distributions**.

Our formulation is based on solving the dispersion relation where the frequency is determined as a function of wave vector, and thus plotting growth rate against directly reflects the

solution structure and spatial characteristics of the instability. This approach effectively captures the key physical insights such as growth length, resonance conditions, and anisotropy effects which are central to our theoretical model.

While frequency-based growth plots are indeed informative, they would require a reformulation or interpolation of the dispersion relation outputs, which falls beyond the intended scope of the present work. Nonetheless, we acknowledge the merit of such analysis and will consider incorporating frequency-resolved growth plots in future studies to complement the spatial perspective presented here.

We once again thank the reviewer for the constructive feedback that has helped improve the manuscript. We hope that the revised version now meets the requirements for publication.