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Response to the Comment by Chandra S on "Interaction of Ion Cyclotron Electromagnetic Wave with Energetic Particles in the Existence of Alternating Electric (AC) Field Using Ring Distribution"

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Chandra (2023) raised the question on the expression by Kumari & Pandey (2019).

$$\varepsilon_{ij}(k,\omega)=1+\sum_{s}\frac{4e_s^2\pi}{(\beta m_s)^2\omega^2}\sum_{n}\sum_{p}J_p(\lambda_2)\int\frac{\left\|S_{ij}^*\right\|d^3p}{\omega-\frac{k_{\|}p_{\|}}{\beta m_e}-\frac{k_{\|}\Gamma_z}{\beta v}+pv-\frac{n\omega_e}{\beta}} \quad (1)$$

where S_{ij} in below form

$$\begin{vmatrix} -N^2+\varepsilon_{11} & \varepsilon_{12} & N^2+\varepsilon_{13} \\ \varepsilon_{21} & -N^2+\varepsilon_{22} & \varepsilon_{23} \\ N^2+\varepsilon_{31} & \varepsilon_{32} & \varepsilon_{33} \end{vmatrix} \quad (2)$$

After using the limits $k\perp \rightarrow 0$ and $k_{II} = k$ generalized dielectric tensor becomes simplified tensor and generalized dispersion relation reduces as

$$\left\|\begin{matrix} -N^2+\varepsilon_{11} & \varepsilon_{12} & 0 \\ \varepsilon_{21} & -N^2+\varepsilon_{22} & 0 \\ 0 & 0 & \varepsilon_{33} \end{matrix}\right\| = 0 \quad (3)$$

Above expression is rewritten in more convenient form for electromagnetic waves

$$N^4-2\varepsilon_{11}N^2+\varepsilon_{11}^2+\varepsilon_{12}^2=0 \quad (4)$$

For electrostatic waves $\varepsilon_{33} = 0$. Neglecting the higher power of N therefore we get resulting generalized dispersion relation.

Chandra (2023) reported in his comments that alternating current (AC) electric field parallel to magnetic field and dispersion relation is too complicated to solve. I agree with Chandra comment the dispersion relation is too complicated in practice and cannot express in simple relation. Therefore we derive dispersion relation as given in equation (1) basis of the following theory, assumptions and literature review.

1. The theory used in my paper is based on wave-particle interaction by using linear theory.
2. The method used to derive dispersion relation is method of characteristic solutions and kinetic approach.

For more detail of this equation (1) in manuscript Shukla et al. (2022) and their cited papers Kumari & Pandey (2019). In past work done by Misra & Haile (1993) in the presence of parallel AC electric on the basis of method of characteristic solutions and kinetic effect. The comment given by Chandra is only raise the question on my expression. However he did not give any new expression against the expression. Therefore his comment is not justified to raise the question on my manuscript.

Dr. Chandra suggested two of his paper where he claimed to give correct equation. I have gone through his paper

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and found that he did not consider AC electric field in the expression of dispersion relation and I think, his manuscript is not appropriate for justifying the of my expression.

Chandra (2023) gave very general statement for AC electric field parallel to magnetic field. In addition, he claimed that my expression is simple and it cannot applicable and are not reliable. If we remove the contribution of AC electric field and relativistic factor $\beta \rightarrow 1$ then the expression is similar to available literature (Cuperman & Landau 1974, Sazhin et al. 1992).

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