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Magnetorotational Instability in Collisional Weakly Ionized and Magnetized Electron-Positron-Ion Plasmas
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The rotating plasma instabilities especially magnetorotational instability (MRI) have been the subject of considerable investigations in the last decade due to the numerous astrophysical applications, such as region of accretion disks surrounding the central of black holes and protoplanetary disks. Recently, it has been shown that the accretion and protoplanetary disks can be considered as weakly and partially ionized with varying degrees of ionization containing a large fraction of neutral atoms. The presence of neutrals in partially ionized multi-component plasmas significantly affects the growth rate and instability condition of the MRI where non-ideal effects (Hall effect, ambipolar diffusion, and Ohm dissipation) are taken into account [1-3].
In this work, considering a weakly ionized and magnetized rotating plasma consisting of electron-positron-ion in the neutral background, the magnetorotational instability has been investigated by using multi-fluid model. Satisfying the current neutrality and homogeneity of the system in the equilibrium state by assuming the same unperturbed angular velocity for charge species and neutrals, the equilibrium magnetic field has been considered as homogeneous and purely axial. Taking into account the collisional coupling of charge species with neutrals and considering weakly ionized condition, the growth rate and the wavenumber range of MRI have been obtained [4]. Deriving the dispersion relation (DR) in arbitrary and high frequency regimes, the instability conditions have been analytically obtained. It is shown that the presence of light positive species, i.e. positrons, can be significantly modified the range and magnitude of the instability. Moreover, numerical investigation of DR in the general case shows that the presence of positrons, not only increase the maximum growth rate of MRI in the low number density ratio of light to massive positive species but also broadened the wavenumber range of the instability. The obtained results of the present investigation will greatly contribute to the understanding of the particles dynamics as well as dissipation mechanism in some astrophysical environments, such as accretion and protoplanetary disks.

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