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Gravitational instability in magnetized viscoelastic fluid with radiation pressure and Ohmic diffusion

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The gravitational instability plays a fundamental role in the star formation mechanism in interstellar medium. This study examines the gravitational instability of a finitely conducting magnetized viscoelastic fluid, under the influence of radiation pressure within the framework of a generalized hydrodynamic (GH) fluid model [1]. The general dispersion relation, valid for strongly and weakly coupled fluids under kinetic and hydrodynamic limits respectively, is derived using normal mode analysis for a transverse wave propagation mode. The obtained Jeans instability criteria, in terms of critical Jeans wavenumbers under both limits, are modified by the presence of radiative effects, viscoelastic compressional speed, and Alfven wave velocity. The findings highlight that viscoelastic compressional speed and radiative pressure slow the Jeans instability's growth rate, exerting a stabilizing effect on the initiation of gravitational collapse. The present investigation provides valuable insights into the role of radiative mechanisms in the gravitational collapse within the strongly coupled region of molecular cloud clumps [3].

References

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