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Internal waves and Rayleigh-Taylor instability in magnetized compressible strongly coupled dusty plasmas

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This paper investigates the influence of compressibility on the internal wave modes and density gradient-driven Rayleigh-Taylor (R-T) instability in magnetized strongly coupled dusty plasmas. The dusty magnetohydrodynamic model is formulated for compressible fluids, accounting for the effects of weakly coupled electrons/ions and strongly coupled dust particles under the influence of the gravitational field. The effect of the magnetic field on dust dynamics has been incorporated through the magnetic force on the electrons and ions in quasineutral dusty plasmas. The dispersion relation of R-T instability has been derived which has been modified due to the compressibility effect, dust acoustic wave speed, and viscoelastic coefficients. The shear Alfvén and compressional viscoelastic wave modes get coupled in the dispersion characteristics. The modified R-T instability criterion is derived in terms of the Alfvén speed, viscoelastic effects and dust grain parameters. The graphical illustrations show that the growth rate of R-T instability has been suppressed due to compressibility, viscoelastic coefficients and dust acoustic speed. The results are useful to discuss the development of R-T instability in magnetized astrophysical dusty plasmas.