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Heat-Flux Suppression by Kinetic Instabilities in High-β, Weakly Collisional, Magnetized Plasma[1] EVAN YERGER, Princeton Plasma Physics Laboratory, PO Box 451, Princeton NJ, 08543, USA, MATTHEW KUNZ, ANATOLY SPITKOVSKY, Department of Astrophysical Sciences, Princeton University, Peyton Hall, Princeton NJ, 08544, USA — High-β plasmas can be highly magnetized ($\rho/H \ll 1$) at the largest astrophysical scales, e.g., in the intracluster medium of galaxy clusters. If the plasma is furthermore weakly collisional, the transport of momentum and heat is highly anisotropic with respect to the magnetic field direction. Such transport can result in significant parallel heat flux and pressure anisotropy, which trigger kinetic instabilities that back-react on the transport. In this work, we use the particle-in-cell code Tristan-MP to calculate the steady-state heat flux through a stratified, high-β, collisionless, magnetized plasma. The consequent departures from a Maxwellian distribution function excite the heat-flux-driven whistler instability and the pressure-anisotropy-driven mirror instability. Both instabilities reduce heat transport by scattering and/or trapping particles (e.g., Roberg-Clark et al. 2018; Komarov et al. 2016, 2018). By tracking thousands of particles and simulating across a range of β and ion-electron mass ratio, we construct a space- and time-resolved, energy-dependent collision operator which quantitatively describes the effect of the saturated instabilities on particle motion, and therefore on the transport properties of the plasma.

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