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A PIC Simulation Study of Electron Viscosity and Thermal Conduction in Collisionless Plasmas MARIO RIQUELME, Univ de Chile, ELIOT QUATAERT, University of California, Berkeley, DANIEL VERSCHAREN, University of New Hampshire — We use particle-in-cell (PIC) simulations to study the interplay between electron- and ion-scale velocity-space instabilities and their effect on electron pressure anisotropy, viscous heating, and thermal conduction. The adiabatic invariance of the magnetic moment in low-collisionality plasmas gives rise to pressure anisotropy, with $p_{\perp,j} - p_{\|,j} > 0$ (< 0) if the magnetic field magnitude $|\vec{B}|$ grows (decreases), where $p_{\perp,j}$ and $p_{\|,j}$ denote the pressure of species j [electron or ion] perpendicular and parallel to $\vec{B}$. If the resulting anisotropy is large enough, it can trigger small-scale plasma instabilities. By imposing a shear in the plasma we either amplify or decrease the magnetic field $|\vec{B}|$. When $|\vec{B}|$ is amplified, we explored the nonlinear regime of the mirror, ion-cyclotron, and electron whistler instabilities. When $|\vec{B}|$ is decreased, we studied the nonlinear regime of the ion- and electron-firehose instabilities. We discuss the implications of our results for electron heating and thermal conduction in low-collisionality accretion flows onto black holes, like Sgr A*. We also discuss the possible implications for the thermal conductivity of plasma in the outer parts of massive, hot, galaxy clusters.

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