Nonlinear Ion-Acoustic Anomalous Resistivity From Real Mass Ratio Vlasov Simulations

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Collisionless magnetic reconnection requires the violation of ideal MHD by various kinetic-scale effects such as wave-particle interactions. The non-linear evolution of the ion-acoustic instability and its resulting anomalous resistivity is studied by examining the properties of a statistical ensemble of Vlasov simulations. The current-driven ion-acoustic instability is produced in Maxwellian electron-ion plasmas with low number density, real mass ratio and low electron to ion temperature ratio, appropriate to collisionless space plasmas. We study the evolution of the ensemble probability distribution of anomalous resistivity values produced during the linear, quasi-linear and non-linear evolution of the ion-acoustic instability. The ensemble probability distribution is found to be Gaussian. The ensemble mean of the ion-acoustic resistivity during the non-linear regime is higher than estimates at quasi-linear saturation and the ensemble standard deviation is comparable to the ensemble mean. Ion-acoustic resistivity could provide a natural source of localized resistivity for collisionless magnetic reconnection.