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Landau damping of magnetic fluctuations inhibit the dynamo in weakly collisional nonmagnetized plasmas ISTVAN PUSZTAI, Chalmers Univ Techn, JAMES JUNO, Univ Maryland, AXEL BRANDENBURG, NORDITA, KTH, and Stockholm Univ, JASON M. TENBARGE, Princeton Univ, and PPPL, AMMAR HAKIM, PPPL, MANAURE FRANCISQUEZ, MIT, ANDRÉAS SUNDSTRÖM, Chalmers Univ Techn — We perform fully kinetic simulations of flows known to produce dynamo in magnetohydrodynamics (MHD), considering scenarios with low Reynolds number and high magnetic Prandtl number, with relevance to fluctuation dynamos in galaxy clusters. We find that Landau damping on the electrons leads to a rapid decay of magnetic perturbations (apart from those corresponding to a current caused by the forcing of the flows), impeding the dynamo. The effect of the magnetic Landau damping is similar to that of a magnetic diffusivity that scales with the wave number of the perturbation. This collisionless damping process operates on spatial scales where electrons are nonmagnetized, reducing the range of scales where the magnetic field grows in high magnetic Prandtl number fluctuation dynamos. When electrons are not magnetized down to the resistive scale, such as galaxy clusters at typical Biermann battery seed fields, the magnetic energy spectrum is expected to be limited by the scale corresponding to magnetic Landau damping or, if smaller, the electron gyroradius scale, instead of the resistive scale, potentially reducing the total energy in magnetic fluctuations. In simulations we thus observe decaying magnetic fields where resistive MHD predicts a dynamo.

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