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# Anomalous Resistivity of Collisionless Space Plasmas

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Resistivity in current carrying space plasmas creates electric fields which can accelerate particles. It also may allow magnetic reconnection to take place. Unfortunately, the classical resistivity due to binary particle collisions ("Spitzer-resistivity"), is too small to accelerate particles, e.g. in auroral regions to explain the observed energies. The magnetic Lundquist numbers (Reynolds numbers for the Alfvà velocity) calculated for a collisional resistivity, are for the characteristic scales of solar flares, CME eruptions and magnetospheric substorms far to large to allow magnetic reconnection. Hence, for decades the existence of an "anomalous" resistivity has been conjectured for collisionless space plasmas. Unfortunately, historically the term "anomalous" was coined, although it was obvious from the very beginning that collisionless plasmas will, of course, find theirway to dissipate the current energy. Just that instead by Coulomb collisions the momentum transfer away from the current carriers is replaced effectively by an interactionwith the electromagnetic fields of collectively excited plasma waves. In the early years of plasma physics, in the 60ties of the last century, the quasi-linear theory was invented to describe the interaction between current carrying particles and the collectively excited weak electromagnetic turbulence. In fact, the quasi-linear theory provided first estimates of a possible level of "anomalous" resistivity due to wave-particle interactions. Since than powerful computer simulation approaches have been developed which allowed to investigate the essentially strongly non-linear response of a collisionless plasma to realistic amounts of externally driven current flows. We discuss the state of the art of the investigationof the "anomalous" resistivity problem of collisionless plasmas. Recent investigations have led far beyond the limits of the quasi-linear theory. We especially emphasis the importance of the particle interaction with coherent phase space structures. The latter are ultimately and self-consistently formed as a self-organizing reaction of the plasma to realistic amounts of current flows. Coherent structures form quickly since a current instability almost immediately passes through its preliminary preparatory linear and quasi-linear stages. More realistic than ever kinetic simulations have been carried out, for the real electron-to ion mass ratio and with open boundaries which allow to consider the reactionof the plasma to constantly driving external currents. It was shown, for example that depending on the plasma parameters and current strength the level of "anomalous" resistivity of collisionless plasmas does exceed the quasi-linear prediction by at least an order of magnitude.