

On Dissipations in MHD fluids

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To treat dissipation processes in relativity has been a problematic issue. A straightforward extension of Navier-Stokes equation to relativity is known to violate causality, since the dissipation velocity becomes infinite in the large wave number limit. So called “causal fluid dynamics” has been proposed to overcome this difficulty, however, this is not a final solution to the problem, especially when it comes to applications.

In a neutral fluids, dissipations can take place in the form of heat conduction, friction, and particle number diffusion; all these three have causality problem. There can be another kind of dissipation, the Ohmic dissipation namely, in an MHD fluid. It can be shown that the Ohmic dissipation results in finite dissipation velocities, thus it does not have causality problem. However, it also suffers from problems similar to those in causal fluid dynamics. The detailed analysis on the problems and possible way towards the solution will be presented.