



Electro-diffusion in a plasma with two ion species

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Electric field is a thermodynamic force that can drive collisional inter-ion-species transport in a multicomponent plasma. In an inertial confinement fusion (ICF) capsule, such transport causes fuel ion separation even with a target initially prepared to have equal number densities for the two fuel ion species. Unlike the baro-diffusion driven by ion pressure gradient and the thermo-diffusion driven by ion and electron temperature gradients, electro-diffusion has a critical dependence on the charge-to-mass ratio of the ion species. Specifically, it is shown here that electro-diffusion vanishes if the ion species have the same charge-to-mass ratio. An explicit expression for the electro-diffusion ratio is obtained and used to investigate the relative importance of electro- and baro-diffusion mechanisms. In particular, it is found that electro-diffusion reinforces baro-diffusion in the deuterium and tritium mix, but tends to cancel it in the deuterium and helium-3 mix.

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