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Multispecies plasma transport issues in ICF ERIK VOLD, KIM MOLVIG, ARCHIS JOGLEKAR, MARIO ORTEGA, Los Alamos Natl Lab — In recent years there has been a renewed interest in plasma transport, both at the kinetic level and in multi-species fluid approximations, to better understand observed degradation in ICF performance. Analysis and numerical computations of multi-species fluid approximations examine the roles of plasma viscosity and species mass flux driven by gradients in composition, ion and electron pressure (barodiffusion) and temperature (Soret effect). The mix layer between plasma species and the pressure and temperature gradient coefficients are sensitive to the choice of composition as a molar or mass fraction, and implications are examined. A central focus here is to compare the coefficients of the gradient force terms determined from a rigorous kinetic derivation (Molvig, et.al., 2014) to other forms derived for the transport coefficients. The particle velocity dependence of the Coulomb collisions determines species friction drag and thus limits the species drift flux, leading to a dependence of the diffusion coefficient on the averaged particle mass through the mix layer profile, unlike that in molecular diffusion. This factor combined with the barodiffusion and kinetic coefficients determines a highly asymmetric mix layer profile shape between low z and high z plasma components near total pressure and temperature equilibrium. The temperature gradient can act to inhibit or increase the species mass flux and examples relevant to ICF are given. Plasma viscosity in the momentum equation is shown to significantly modify a 1D ICF convergence trajectory and reduces maximum temperature, while accounting for viscous dissipation of the energy.

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