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1P41 - A Fluid Solver approach via Discontinuous Galerkin Methods to Viscoelastic Models for dense plasmas

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We seek a nonequillibrium, heterogenous, large-scale model for strongly coupled plasmas. We generate a generalized hydrodynamic model for strongly coupled plasmas using density functional theory closures of BBGKY hierarchies via hypernetted chain theory. We formulate these equations in the form of a balance law, thereby providing a ‘’memory” effect, facilitating correlation. This isothermal “single fluid” form of the electrostatic limit is modelled in a fluid context with an exact form of the functional term that is a non-local integral term rising out of hypernetted chain theory. These models, dubbed the Visco-Elastic Density functional (VEDF) equations, provide the first continuum models that match the dispersion of waves in electrostatic ultra-cold correlated plasmas. The resulting equations admit no quasilinear homogenous form and thus we recast the equations as a balance law system treated regionally-implicitly with DG-FEM. We use the DG cell sizes to represent a spatial scale over which model parameters are constant. The generalized pressure and dissipative stress are handled explicitly via a multi-cell reconstruction, as we assume the relevant length scales are different than the length scales of the cells. Here we present work towards a 3D VEDF Solver software package, highlighting our approach to computing the correlation contribution to the generalized pressure.

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