Modeling of fluid plasma equations has become increasingly important in the high energy density plasma community. High energy density plasmas are typically characterized by very fast time scales and high density plasmas, a regime where fluid plasma models are important. So far, the investigation of fluid plasma models relevant in these regimes such as Two-Fluid plasmas and Hall MHD has been relatively low priority in the applied mathematics community in favor of non-dispersive fluid plasma systems such as MHD. This paper will present some of the interesting challenges that these dispersive, non-diffusive fluid plasma models introduce to algorithm developers. Results obtained using finite volume and discontinuous Galerkin approximations of various dispersive plasma models will be presented. Discussion of the large variety of relevant applications including field reversed configurations, helicon thrusters, z-pinches and problems of general plasma science interest such as collisionless magnetic reconnection will be discussed to help foster interest in the topic in the applied mathematics community.