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DISCONTINUOUS GALERKIN METHOD FOR INHERENT COUPLING OF RADIATION TRANSPORT AND HYDRODYNAMICS

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In the field of laser generated high energy density physics, hydrodynamics is considered to be a very popular approach of continuum description of plasma. Radiation, as another physical phenomenon, takes its significant part in energy transport [1] and [2]. This multi-physics context can be found e.g. in Tokamaks and Inertial Confinement Fusion systems and a great effort has been engaged to simulate its complex behavior, e.g. [4] and [5]. Our proposed method couples plasma and radiation field in an inherent way, where for radiation we use the photons transport equation model solved by Discontinuous Galerkin (DG) method. Solution of the system of radiation transport equation and hydrodynamic energy equation requires an implicit treatment due to the radiation source term which is responsible for radiation and hydrodynamics coupling. At first, the solution of the radiation transport equation is delivered by DG, while treating the radiation source term as an unknown function. Then, the Symmetrical Semi Implicit (SSI) method [3] is used to solve the hydrodynamic energy equation already including the DG solution. By its nature, SSI allows us to treat the problem locally. Summing up, we merged the SSI method and DG scheme to obtain an implicit, local, stable, and conservative method to solve the radiation transport and hydrodynamic energy equations. After implementing our method into our hydrodynamical code, we simulated an interaction of laser with thin foil, and subsequently, analyzed the influence of radiation transport on evolution of laser generated plasmas.

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