Asymptotic preserving multilevel DG for the interaction of light and matter

Guido Kanschat[1,*]

[1] *Interdisziplinäres Zentrum für Wissenschaftliches Rechnen (IWR), Ruprecht-Karls-Universität Heidelberg*

[*] Email: `kanschat@uni-heidelberg.de`

The energy balance of light and matter imposes diffusive behavior in the esymptotic limit of high density. The numerical approximation of this limit is quite delicate and discretization methods must be designed with some care in order to achieve it. On the other hand, violation of the asymptotic limit by the numerical scheme yields qualitatively wrong approximations for even moderate densities.

We discuss the reasons for breakdown of the standard method and ways to preserve asymptotic behavior. In numerical experiments, we show that multilevel domain decomposition solvers work almost out of the box for asymptotic preserving discretizations. We present applications to light in dense nonabsorbing media as well as to local thermodynamic equilibrium between light and matter.