Asymptotic-preserving IMEX-DG methods for linear kinetic transport equation

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We consider a linear kinetic transport equation under a diffusive scaling, that has a diffusive equation as the limit when the Knudsen number goes to zero. The equation provides a prototype model to study many systems, including neutronic dynamics and radiation transfer. One type of numerical methods that can simulate such multi-scale models efficiently is the asymptotic preserving (AP) method. Our focus here is on devising accurate AP methods, that are *uniformly* stable from transport to diffusive regimes, by applying discontinuous Galerkin (DG) methods in space and implicit-explicit (IMEX) Runge-Kutta methods in time. We will present several families of IMEX-DG methods based on different reformulations of the model and different IMEX strategies. Computational complexity and theoretical findings will be discussed, along with some numerical examples. This is based on joint work with Y. Cheng, J. Jang, Z. Peng, J.-M. Qiu, T. Xiong.