Higher-order Gas-kinetic Schemes for Navier-Stokes Equations

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The higher order CFD methods for compressible flow are mostly based on WENO and DG formulations, where the exact or approximate Riemann solver is used for the flux evaluation. The use of the 1st-order Riemann flux function may be the barrier for the development of accurate, robust, and efficient methods. In CFD community, the necessity of using high-order flux function, such as those based on the generalized Riemann problem and gas-kinetic scheme, has not been fully recognized. In this talk, we are going to demonstrate the importance of high-order time accurate gas evolution model, and its usage in the development of higher-order schemes. The superior advantages of the newly developed higher-order gas kinetic schemes over the existing WENO and DG methods in terms of accuracy, robustness, and efficiency will be presented.