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Physical diffusion suppresses the carbuncle instability KE SHI, ALEKSANDER JEMCOV, JOSEPH POWERS, Univ of Notre Dame — We demonstrate a simple antidote exists to the numerical carbuncle instability predicted by some shock-capturing schemes: inclusion of physical momentum and energy diffusion via a compressible Navier-Stokes solution to the supersonic flow of a calorically perfect ideal gas past a circular cylinder. We demonstrate the carbuncle phenomenon and its rectification by solving two problems. Both employ the same geometry, initial conditions, computational grid, time step size, advective flux model of a Roe-based scheme without an entropy fix, and time-advancement scheme. For the first problem, we neglect physical diffusion, while for the second we include it. When physical diffusion is neglected, we predict a carbuncle phenomenon; however, when it is included and sufficiently resolved, no carbuncle is predicted, in agreement with experiment.

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