Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Supercritical Radiative Shocks Do Not Exist R. PAUL DRAKE, University of Michigan — The concept of a supercritical regime for radiative shocks arose historically in the context of media that are optically thick to x-rays. Such a shock has an upstream state, a precursor region, a density jump, a downstream cooling zone, and a downstream steady state. From thermodynamic arguments, the temperature T_p in the (presumed near LTE) precursor region cannot exceed that in the final downstream state, T_f. Fluid dynamics analysis shows that T_p might have any value up to T_f. If one uses an "equilibrium diffusion" model for the radiation transport (a single group diffusion model), one concludes that there is a "supercritical" regime in which $T_p = T_f$ and in which the temperature gradient across the density jump provides the required upstream energy flux. However, the equilibrium diffusion model cannot be valid near such a shock. By simple analysis of the energy balance, or by more reasonable treatment of the radiation transport, one can show that such shocks never actually reach the supercritical regime, which is better viewed as a limiting case. This research was sponsored by the National Nuclear Security Administration under the Stewardship Science Academic Alliances program through DOE Research Grant DE-FG52-03NA00064, and other grants and contracts.

R. Paul Drake
University of Michigan

Date submitted: 02 Aug 2005 Electronic form version 1.4