Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

On Numerical Heating[1] MENG-SING LIOU, NASA Glenn Research Center — The development of computational fluid dynamics over the last few decades has yielded enormous successes and capabilities that are being routinely employed today; however there remain some open problems to be properly resolved. One example is the so-called overheating problem, which can arise in two very different scenarios, from either colliding or receding streams. Common in both is a localized, numerically over-predicted temperature. Von Neumann reported the former, a compressive overheating, nearly 70 years ago and numerically smeared the temperature peak by introducing artificial diffusion. However, the latter is unphysical in an expansive (rarefying) situation; it still dogs every method known to the author. We will present a study aiming at resolving this overheating problem and we find that: (1) the entropy increase is one-to-one linked to the increase in the temperature rise and (2) the overheating is inevitable in the current computational fluid dynamics framework in practice. Finally we will show a simple hybrid method that fundamentally cures the overheating problem in a rarefying flow, but also retains the property of accurate shock capturing. Moreover, this remedy (enhancement of current numerical methods) can be included easily in the present Eulerian codes.

[1]This work is performed under NASA's Fundamental Aeronautics Program.

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Date submitted: 02 Aug 2013

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