

MATHEMATICS & STATISTICS COLLOQUIUM ANNOUNCEMENT

Monday, March 10, 2008
3:30 - 4:30
GEOL 155

SPEAKER

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TITLE

Modeling the von Neumann triple point paradox

ABSTRACT

Experimental observations of the reflection of very weak shock waves off a thin wedge show a pattern that closely resembles Mach reflection, in which the incident, reflected, and Mach shocks meet at a triple point. However, von Neumann showed in 1943 that a triple point configuration, consisting of three shocks and a contact discontinuity meeting at a point, is impossible for sufficiently weak shocks. In spite of intensive study, no resolution of this "von Neumann paradox" has been available until recently.

We present numerical solutions of two-dimensional Riemann problems for a sequence of systems of conservation laws that describe the reflection of weak shock waves with increasing physical fidelity. Our most recent solutions are of the full compressible Euler equations, which are the fundamental physical equations. We develop a new numerical scheme to solve the equations in self-similar coordinates, and we observe a surprising structure in the solution: not one, but an entire cascade of triple points with embedded centered rarefactions. We show that the centered rarefaction waves originating at each triple point resolve the paradox. We will also describe current progress towards the goal of analyzing the structure that we observe numerically.

Coffee and Cookies will be available in the Lounge (Room 201 McLean Hall) at 3:00 pm.