THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Analysis and PDE Seminar

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3:00 - 4:00 p.m.
PH 328

The relativistic Euler equations with a physical vacuum boundary

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Abstract. We consider the relativistic Euler equations with a physical vacuum boundary and an equation of state $p(\varrho) = \varrho^\gamma$, $\gamma > 1$. We establish the following results:

- local well-posedness in the Hadamard sense, i.e., local existence, uniqueness, and continuous dependence on the data,
- low regularity solutions: our uniqueness result holds at the level of Lipschitz velocity and density, while our rough solutions, obtained as unique limits of smooth solutions, have regularity only a half derivative above scaling,
- stability: our uniqueness in fact follows from a more general result, namely, we show that a certain nonlinear functional that tracks the distance between two solutions (in part by measuring the distance between their respective boundaries) is propagated by the flow,
- we establish sharp, essentially scale invariant energy estimates for solutions,
- we establish a sharp continuation criterion, at the level of scaling, showing that solutions can be continued as long as the velocity is in $L^1_t Lip_x$ and a suitable weighted version of the density is at the same regularity level.

This is joint work with Mihaela Ifrim and Daniel Tataru.