1063-35-275 **Steve Shkoller*** (shkoller@math.ucdavis.edu), Department of Mathematics, Davis, CA 95616.

Well-posedness in smooth function spaces for the moving-boundary 3-D compressible Euler equations in physical vacuum.

We prove well-posedness for the 3-D compressible Euler equations with moving *physical* vacuum boundary, with an equation of state given by $p(\rho) = C_\gamma \rho^\gamma$ for $\gamma > 1$. The physical vacuum singularity requires the sound speed c to go to zero as the square-root of the distance to the moving boundary, and thus creates a degenerate and characteristic hyperbolic *free-boundary* system. We establish the existence of unique solutions to this system on a short time-interval, which are smooth (in Sobolev spaces) all the way to the moving boundary, and our estimates have no derivative loss with respect to initial data. Our proof is founded on an approximation by a degenerate parabolic regularization obtained from a specific choice of a degenerate artificial viscosity term together with a new higher-order Hardy-type inequality. This is joint work with Daniel Coutand. (Received August 17, 2010)