Geometric aspects of hydrodynamic blowup

Stephen C. Preston
Department of Mathematics, University of Colorado, Boulder, CO 80302, U.S.A.
Tel: 303-4925026, email: Stephen.Preston@colorado.edu

Abstract:

The Arnold approach to hydrodynamics views ideal fluid flows as geodesics on the Riemannian manifold of volume-preserving diffeomorphisms. The curvature of this manifold is related to stability of the fluid in Lagrangian coordinates; it is known to be mostly negative but sometimes positive.
In this talk, I will describe how a strengthened version of the Beale-Kato-Majda criterion for blowup of the Euler equation on T^3 can be interpreted geometrically, in terms of the appearance of conjugate point locations near the blowup time. The result is that blowup implies either the appearance of an infinite sequence of conjugate points (which can be detected geometrically), or a specialized form for the deformation tensor near the blowup location.

References:

1. S.C. Preston, Comm. Math. Phys. 267, 493-513 (2006).
2. S.C. Preston, "A geometric rigidity theorem for hydrodynamic blowup," preprint (2009).