Cavitation and Concentration in Entropy Solutions of the Compressible Euler Equations and Related Nonlinear PDEs in Fluid Dynamics

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Abstract

In this talk, we will discuss the intrinsic phenomena of cavitation/decavitation and concentration/deconcentration in entropy solutions of the compressible Euler equations and related nonlinear PDEs in fluid dynamics, which are fundamental to understanding the well-posedness and solution behavior of nonlinear PDEs. We will start to discuss the formation process of cavitation and concentration in entropy solutions of the isentropic Euler equations with respect to the initial data and the vanishing pressure limit. Then we will analyze a longstanding fundamental problem in fluid dynamics: Does the concentration occur generically so that the density develops into a Dirac measure at the origin generically in spherically symmetric entropy solutions of the multi-dimensional compressible Euler equations and related nonlinear PDEs in fluid dynamics? We will report our recent results and approaches developed for solving this longstanding open problem for the Euler equations, the Euler-Poisson equations, and related nonlinear PDEs in fluid dynamics and discuss its close connections with entropy methods and the theory of divergence-measure fields. Further related topics, perspectives, and open problems will also be addressed.