Critical thresholds on pressure-less Navier-Stokes equations with nonlocal viscocity

Changhui Tan
University of Maryland
ctan@cscamm.umd.edu

The global existence of strong solutions for Navier-Stokes equations is one of the most challenged problems in the study of partial differential equations. In this talk, we discuss about the pressure-less compressible Navier-Stokes equations with regularized nonlocal viscosity

$$\begin{cases} \rho_t + \nabla \cdot (\rho \mathbf{u}) = 0, \\ \mathbf{u}_t + \mathbf{u} \cdot \nabla \mathbf{u} = \int_{\mathbb{R}^n} \phi(\mathbf{x}-\mathbf{y})(\mathbf{u}(\mathbf{y},t) - \mathbf{u}(\mathbf{x},t))\rho(\mathbf{y},t)d\mathbf{y}, \end{cases}$$

where the kernel ϕ is bounded and Lipschitz. The system is related to the hydrodynamic discription of the Cucker-Smale flocking model. Taking advantage of the non-locality of the viscosity, we establish critical thresholds for the initial profiles, which guarantee existence of global strong solutions for the system.

References

[1] S. Engelberg, H. Liu and E. Tadmor, Critical threshold in Euler-Poisson equations, *Indiana Univ. Math. J.*, **50** (2001), pp. 109-157

[2] S.-Y. Ha and E. Tadmor, From particle to kinetic and hydrodynamic descriptions of flocking, *Kinetic and Related Models*, **1(3)** (2008), pp. 415-435.

[3] H. Liu and E. Tadmor, Critical thresholds in convolution model for nonlinear conservation laws, *SIAM J. Math. Anal.* **Vol.33, no. 4**, pp. 930-945.

[4] S. Motsch and E. Tadmor, A new model for self-organized dynamics and its flocking behavior, *J. Stat. Phys*, **144(5)** (2011), pp. 923-947.

Joint work with: Eitan Tadmor (*University of Maryland*).