On Multi-Dimensional Compressible Navier-Stokes Systems with Large Oscillations and Vacuum

Zhouping Xin

The Chinese University of Hong Kong, `zpxin@ims.cuhk.edu.hk`

Abstract

In this talk, I will discuss some of the recent results on the large time well-posedness of classical solutions to the multi-dimensional compressible Navier-Stokes systems with possible large oscillations and vacuum. The focus will be on finite-time blow-up of classical solutions to the 3-dimensional full compressible Navier-Stokes system, and the global existence of classical solutions with small total energy to the isentropic compressible Navier-Stokes system in both 2-d and 3-d in the presence of vacuum and possible large oscillations. In particular, any classical solutions to the 3-d full compressible Navier-Stokes system will blow-up in finite time as long as its initial density contains an isolated mass group, and any weak solutions of Lions-Feireisl with suitable small finite energy will be regular and unique. Some new estimates on the fast decay of the pressure in the presence of vacuum at far fields will be presented, which are crucial for the well-posedness theory in the 2-dimensional case.

References

[1] Cho Y., Choe H. J., Kim H., "On classical solutions of the compressible Navier-Stokes equations with nonnegative initial densities," Manuscript Math., **120**, 91–129 (2006).

[2] Feireisl E., Dynamics of viscous compressible fluids, Oxford University Press, New York (2004).

[3] Huang X. D., Li J., Xin Z. P., "Blow up criterion for viscous baratropic flows with vacuum states," Comm. Math. Phys., **301**, No. 1, 23–35 (2011).

[4] Huang X. D., Li J., Xin Z. P., "Global well-posedness of classical solutions with large oscillations and vacuum to the three-dimensional isentropic compressible Navier-Stokes equations," Comm. Pure Appl. Math., **65**, 549–585 (2012).

[5] Lions P. L., Mathematical Topics in Fluid Dynamics, Vol. 2 Compessible Models, Oxford University Press, New York (1998).

[6] Xin Z. P., "Blow up of smooth solutions to the compressible Navier-Stokes equations with compact density," Comm. Pure Appl. Math., **51**, 229–240 (1998).

[7] Xin Z. P., Yan W., "On blow up of classical solutions to the compressible Navier-Stokes equations," Comm. Math. Phys., **321**, No. 2, 529–541 (2013).

[8] Li J., Xin Z. P., "Global well-posedness and large time asymptotic behavior of classical solutions to the Navier-Stokes equations with vacuum," preprint, IMS-2013-04(194).