Fakultät für Mathematik, Informatik
und Naturwissenschaften
Fachbereich Mathematik

Lothar-Collatz-Kolloquium für Angewandte Mathematik

Donnerstag, den 30. Januar 2020, um 17:15 Uhr, im Hörsaal 5

Prof. Dr. Paolo Antonelli*
(Gran Sasso Science Institute, L'Aquila, Italy)

On the quantum Navier-Stokes system with non-trivial far-field: existence of finite energy weak solutions and low Mach number limit

Zusammenfassung/Abstract:

The quantum Navier-Stokes (QNS) system describes a compressible, barotropic fluid, subject to a stress tensor encoding both viscous and capillary effects. More specifically, the viscosity coefficient is proportional to the mass density and degenerates in the vacuum region, while the capillarity stress depends on the mass density and its derivatives - in a different context (quantum hydrodynamics) this is also interpreted as a correction to the fluid equations encoding quantum effects in the dynamics.
In this talk, I will review some recent results on the QNS system in the three dimensional space with non-zero conditions at infinity for the mass density.
First of all I will show the existence of finite energy weak solutions. The strategy of proof exploits the construction of a sequence of approximating solutions defined through an invading domain approach. The lack of estimates for the velocity field in the vacuum region is overcome by a suitable truncation argument which requires a careful analysis in the limit. The energy and Bresch-Desjardins entropy estimates then give the sufficient compactness. This is done is a recent preprint written in collaboration with Lars Eric Hientzsch and Stefano Spirito.
Moreover I will also discuss the low Mach number limit for the QNS system towards the incompressible Navier-Stokes equations. The main novelty in our study is given by the analysis of the acoustic waves. Indeed the capillarity term contributes by modifying the dispersion relation. By means of a stationary phase argument we are able to provide suitable dispersive estimates showing the convergence to zero of the acoustic part, then the energy and Bresch-Desjardins entropy estimates again yield the convergence towards the incompressible dynamics. This is a joint work with Lars Eric Hientzsch and Pierangelo Marcati.

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Stand: 09.01.2020 (Katrin Kopp)