Nonlocal Dissipation: Modelling Issues and Numerical Analysis

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In the talk we will consider problems from two completely different applications, namely radiative fluids and phase transition in liquid vapor flow. However in both cases nonlocal operators can play an important role and various closely related problems occur for analysis and numerics. These will be studied on the level of simplified model problems. What concerns compressible radiative hydrodynamics, in the so-called nonrelativistic limit one obtains nonlocal contributions in the energy balance equation. These have a mild damping effect much less effective than e.g. heat conductivity. To understand the effect on a rigorous level a scalar model problem is introduced. Basic theoretical properties are presented. On this basis Finite-Volume and Discontinuous-Galerkin schemes are introduced. Kruzkov techniques are applied to ensure convergence. The second part deals with phase transitions in compressible flow for which a whole variety of non-local models have been introduced in the literature. Again we restrict ourselves on a class of scalar model problems which allow rigorous treatments. As the basic numerical algorithm the Discontinuous-Galerkin approach is used and we present convergence results. For both applications numerical simulations are shown which underline the analytical findings.