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Applicability of fluid-dynamical modeling of nucleus-nucleus collisions at relativistic energies DEAN HAZINEH, JUSSI AUVINEN, MARLENE NAHRGANG, STEFFEN BASS, Duke University — At sufficiently high temperatures and densities, similar to the conditions found in the early universe, QCD matter forms a deconfined state called the quark gluon plasma (QGP). This state of matter can be created in collisions of ultra-relativistic heavy-ions, and RHIC data suggests that this QGP behaves similar to an ideal fluid. Viscous relativistic fluid dynamics therefore is one of the preferred theoretical tools to model the time-evolution and properties of the QGP. As the collision energy or the system size is decreased, the range of applicability of viscous fluid dynamics becomes smaller as the length scale of the interaction among the basic constituents is similar to the overall scale of the collision system itself. In order to investigate the validity of fluid-dynamical modeling of proton-nucleus and nucleus-nucleus collisions at LHC and RHIC, we conduct an analysis of the spatial and temporal evolution of the Knudsen number, i.e. the ratio of the microscopic mean free path to the macroscopic length scale of the system. We show results for large and small collision systems, as a function of the specific shear viscosity, and discuss the range of applicability of fluid-dynamical modeling in relativistic proton-nucleus and nucleus-nucleus collisions at different energies.

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None

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