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Hydrodynamic flow in large and small QCD systems formed in relativistic collisions[1]

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The quark-gluon plasma (QGP) produced in ultra-relativistic collisions between large nuclei, such as gold or lead, is a state of QCD matter with extremely high temperature and energy density. The particles produced in these collisions exhibit collective behavior, which is well described by viscous hydrodynamics with very low specific viscosity. The success of hydrodynamics in describing simultaneously a large number of observables led to the notion that QGP is perhaps the most perfect liquid in nature. In the quest for understanding how the perfect fluid emerges, experiments at the Large Hadron Collider (CERN, Switzerland) and the Relativistic Heavy Ion Collider (BNL) studied collisions between protons or other small nuclei with large nuclei, which were not expected to produce QGP but only cold QCD matter. Surprisingly, collective behavior was also found in these small-system collisions. Hydrodynamical models again provide an excellent simultaneous description of a large body of data. How small can a system be and still behave as a liquid, and what are the limits of applicability of hydrodynamics? This talk will focus on the successes and challenges of hydrodynamics applied to large and small QCD systems formed in relativistic collisions.

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