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Hydrodynamics and RHIC data: successes, failures, and what comes next

RON BELMONT, Univ of NC - Greensboro

In the standard model of heavy ion physics, energetic collisions of relativistic nuclei both large and small create a quark-gluon plasma that evolves hydrodynamically. A wide body of experimental evidence in support of this pictures has been collected over the last two decades of RHIC operations, alongside earlier data from the AGS and SPS and more recent data from the LHC. As a paradigm, this view seems to have very strong foundations. However, upon careful scrutiny, a portion of the body of experimental results has either not yet been described by hydrodynamics or exists in tension with current calculations. In this talk, we will discuss both the successes and failures of hydrodynamics and consider the possibilities for what comes next.