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Crossover Equation of State Compared to Lattice QCD and to Baryon Fluctuations in the RHIC Beam Energy Scan[1] JOSEPH KAPUSTA, MICHAEL ALBRIGHT, University of Minnesota, CLINT YOUNG, Michigan State University — We match hadronic equations of state at low energy densities to a perturbatively computed equation of state of quarks and gluons at high energy densities. The hadronic equations of state include all known hadrons; repulsive interactions are taken into account via two versions of the excluded volume approximation. A switching function is employed to make the crossover transition from one phase to another without introducing a thermodynamic phase transition. A fit to accurate lattice calculations of the pressure and trace anomaly, with temperature $100 < T < 1000$ MeV and $\mu = 0$, determines the parameters. These parameters quantify the behavior of the QCD running gauge coupling and the hard core radius of the nucleon. With no new parameters, the pressure and trace anomaly from lattice calculations for $\mu = 400$ MeV are equally well reproduced, as is the speed of sound. We then compute the skewness and kurtosis and compare to measurements of the fluctuations of the proton number distribution in central Au-Au collisions as measured by the STAR collaboration in a beam energy scan at RHIC. The crossover equations of state can reproduce the data if the fluctuations are frozen at a temperature significantly lower than the average chemical freeze-out.

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