Supercomputing the properties of strong interaction matter

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Mapping out the "phase" boundary between the low temperature confining phase of ordinary hadronic matter and the phase of an asymptotically free gas of quarks and gluons is one of the central goals of current theoretical studies of strong interaction matter as well as experiments at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory and the Large Hadron Collider (LHC) at CERN.

Calculating properties of strong interaction matter close to the phase boundary in Quantum Chromo Dynamics (QCD), regularized on a four dimensional space-time lattice, requires large scale numerical simulations on todays fastest supercomputers. I will discuss the generic structure of some of the fluctuation observables used to explore the structure of the phase diagram of strong interaction matter. Furthermore, I will show some numerical results on higher moments of charge fluctuations and compare them with first experimental results obtained by STAR and PHENIX during the first beam energy scan at RHIC as well as ALICE at the LHC.