physikalisches Kolloquium

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QCD Critical Point: An Exciting Odyssey in the Femto-World

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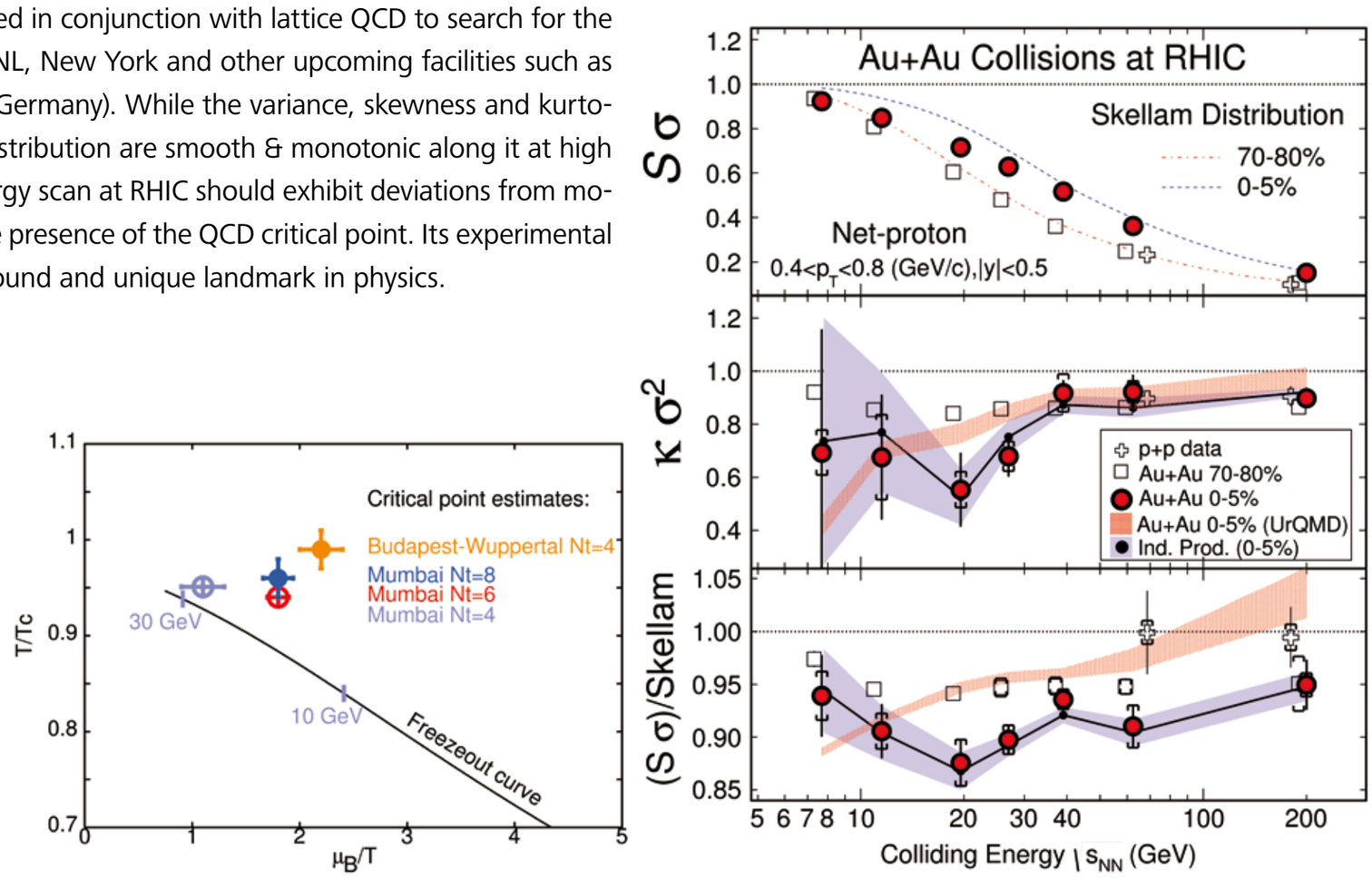
Strongly interacting matter is described by Quantum Chromo Dynamics (QCD), the theory of interactions of quarks and gluons. The large coupling between its constituents necessitates new theoretical tools. QCD on a space-time lattice is the most reliable such tool available to us. One can employ it to look for new phases of the femto-world of quarks and gluons at high temperatures and densities, and investigate their properties in the QCD phase diagram.

QCD critical point has recently attracted a lot of theoretical, and now experimental, attention. I shall present lattice QCD results on it. It is argued that the freeze-out curve in the QCD phase diagram, which embodies a substantial amount of precise experimental data in heavy ion collisions, can be used in conjunction with lattice QCD to search for the critical point at RHIC, BNL, New York and other upcoming facilities such as NICA (Russia) and FAIR(Germany). While the variance, skewness and kurtosis of baryon number distribution are smooth & monotonic along it at high energies, the beam energy scan at RHIC should exhibit deviations from monotonicity, signalling the presence of the QCD critical point. Its experimental discovery will be a profound and unique landmark in physics.



1) Phase diagram from ``QCD at finite chemical potential with Nt=8'' Saumen Datta, Rajiv V. Gavai and Sourendu Gupta, PoS LATTICE2013 (2014) 202; 2) STAR Collaboration, L. Adamczyk et al., Phys. Rev. Lett. 112, 032302 (2014).