UNIVERSITÄT BIELEFELD

Fakultät für Physik

Kolloquium Physik / TR211

Prof. Derek Teaney

Stony Brook University

Soft Pions and the Dynamics of the Chiral Phase Transition

I will first review lattice simulations of the QCD phase diagram, focusing on chiral symmetry and chiral symmetry breaking. In the limit of two massless quark flavors (up and down) the chiral phase transition is second order and is in the O(4) universality class. The fingerprints of this critical point are seen in lattice simulations of real world QCD.
Next I will review heavy ion experiments, presenting an overview of some of the most important measurements from heavy ion collisions. These measurements provide compelling evidence that classical hydrodynamics is an appropriate effective theory for understanding these collisions. In current hydrodynamic simulations of these events, chiral symmetry breaking and its consequences are largely ignored.
However, if the quark mass is small enough, one would expect that the pattern of chiral symmetry breaking seen on the lattice could provide a useful organizing principle for hydrodynamics, increasing its predictive power.
I describe our efforts to simulate the real time dynamics of the O(4) critical point using hydrodynamics. Then I point out some discrepancies between the measured yields of soft pions and current hydrodynamic simulations. I suggest that incorporating the chiral phase transition into the hydrodynamic description could fix the discrepancies.

Monday, July 11, 2022, 4:15 p.m.
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