**The Challenge of Discovering QCD Critical Point**

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Abstract:

Quantum Chromodynamics predicts a variety of unusual states of matter in which relativity and quantum many-body physics strongly intertwine. Discovering phase transitions between these hottest and densest forms of matter in a laboratory is a difficult task. This is the challenge that heavy-ion collision experiments are taking up in the Beam-Energy Scan program at the Relativistic Heavy-Ion Collider (RHIC).   
  
What do we know about the phase diagram of QCD matter and how do we learn more? One of the intriguing open questions is the existence and the location of the QCD critical point. Similar critical points are ubiquitous in earthly substances and the phenomena associated with those points are remarkably universal. How can we use this universality to discover the critical point in QCD? It is a nontrivial question in the context of heavy-ion collisions, in large part because of the importance of non-equilibrium dynamics -- a subject of active recent research.