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Using Higher Moments of Fluctuations and their Ratios in the Search for the QCD Critical Point CHRISTIANA ATHANASIOU, KRISHNA RAJAGOPAL, MIT, MISHA STEPHANOV, University of Illinois — The QCD critical point can be found in heavy ion collision experiments via the non-monotonic behavior of many fluctuation observables as a function of the collision energy. The event-by-event fluctuations of various particle multiplicities and momenta are enhanced in those collisions that freeze out near the critical point. Higher, non-Gaussian, moments of the event-by-event distributions of such observables are particularly sensitive to critical fluctuations, since their magnitude depends on the critical correlation length to a high power. We present quantitative estimates of the contribution of critical fluctuations to the third and fourth moments of the pion, proton and net proton multiplicities and mean transverse momenta, as well as estimates of various measures of pion-proton correlations, all as a function of the same five non-universal parameters, one of which is the correlation length that parametrizes proximity to the critical point. From these several dozen fluctuation observables, many dimensionless ratios can be constructed. We show how to use these ratios to discover the critical point and, if it is found, to overconstrain the values of the non-universal parameters.

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