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Proton Intermittency analysis in Au + Au Collisions: Exploring Critical Behavior in the FAIR Energy Range

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In this presentation, we extend our previous investigations on intermittency using the Scaled Factorial Moment (SFM) technique in Au + Au collisions within the FAIR energy range of 2–12A GeV. Building on our findings published in Eur.Phys.J.A 59 (2023) 4, 92, we now focus on the fluctuations in the number of protons, motivated by QCD-inspired predictions that suggest critical behavior associated with net baryon density fluctuations. Employing a hybrid version of the Ultra-relativistic Quantum Molecular Dynamics (UrQMD) event generator, we analyze the intermittency across pseudorapidity $\chi(\eta)$ and azimuthal $\chi(\phi)$ spaces. Utilizing three equations of state (EoS)—pure Hadron Gas (HG), Chiral + HG, and Bag Model EoS—we explore the distinct intermittent emission patterns and their dependence on incident beam energy. Our findings reveal distinct intermittent behaviors dependent on the chosen EoS, with the Bag Model EoS exhibiting stronger intermittency compared to Chiral+HG. Furthermore, we observe that the strength of intermittency decreases with increasing beam energy. These results highlight the significance of investigating proton fluctuations as a key approach to understanding the critical dynamics of QCD phase transitions and provide insights into the evolution of matter in high-energy collisions.

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