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Event-shape fluctuations and flow correlations in ultra-relativistic heavy-ion collisions

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Abstract. I review recent measurements of a large set of flow observables associated with event-shape fluctuations and collective expansion in heavy ion collisions. First, these flow observables are classified and experiment methods are introduced. The experimental results for each type of observables are then presented and compared to theoretical calculations. A coherent picture of initial condition and collective flow based on linear and non-linear hydrodynamic responses is derived, which qualitatively describe most experimental results. I discuss new types of fluctuation measurements that can further our understanding of the event-shape fluctuations and collective expansion dynamics.

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Keywords: heavy ion collisions, event by event flow, event-shape fluctuations

(Some figures may appear in colour only in the online journal)

1. Introduction

Relativistic heavy ion collisions at the RHIC and the LHC create a hot and dense nuclear matter that is composed of strongly interacting quarks and gluons. This initially produced matter has an asymmetric shape in the transverse plane. Driven by the large pressure gradients arising from the strong interactions, the matter expands collectively and transfers the asymmetry in the initial geometry into azimuthal anisotropy of produced particles in momentum space [1, 2]. Hydrodynamic models are used to understand the space-time evolution of the matter from the measured azimuthal anisotropy. The success of these models in describing the anisotropy of particle production in heavy-ion collisions at RHIC and the LHC [3–9] places

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