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Morphology of High-Multiplicity Events in Heavy Ion Collisions

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We discuss opportunities that may arise from subjecting high-multiplicity events in relativistic heavy ion collisions to an analysis similar to the one used in cosmology for the study of fluctuations of the Cosmic Microwave Background (CMB). To this end, we discuss examples of how pertinent features of heavy ion collisions including global characteristics, signatures of collective flow and event-wise fluctuations are visually represented in a Mollweide projection commonly used in CMB analysis, and how they are statistically analyzed in an expansion over spherical harmonic functions. If applied to the characterization of purely azimuthal dependent phenomena such as collective flow, the expansion coefficients of spherical harmonics are seen to contain redundancies compared to the set of harmonic flow coefficients commonly used in heavy ion collisions. Our exploratory study indicates, however, that these redundancies may offer novel opportunities for a detailed characterization of those event-wise fluctuations that remain after subtraction of the dominant collective flow signatures. By construction, the proposed approach allows also for the characterization of more complex collective phenomena like higher-order flow and other sources of fluctuations, and it may be extended to the characterization of phenomena of non-collective origin such as jets.

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See: [arXiv:1204.0387v1](https://arxiv.org/abs/1204.0387v1) [hep-ph]

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