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A Standard Model for the Little Bang – how far are we from the goal?[1]

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The Little Bangs created in ultra-relativistic heavy-ion collisions share many characteristic features with the cosmological evolution after the Big Bang. I will demonstrate how quantum fluctuations in the initial state of the Little Bang propagate via hydrodynamic evolution (supplemented by an early pre-equilibrated thermalization and a late kinetic freeze-out stage) into the experimentally observed final state, manifesting themselves as fluctuations in the final flow pattern. A harmonic analysis of the final flows, their transverse momentum dependence, their flow angles, and the correlations between them (the "Little Bang flow fluctuation spectrum") provides detailed information from which the spectrum of gluon fluctuations in the initial state and the transport coefficients of the quark-gluon plasma (QGP) fluid created in the collisions can be reconstructed. It will be shown that the initial state fluctuation spectrum and the QGP transport coefficients are intricately entangled in their influence on the measurable observables, and that therefore one cannot be determined without the others. I will report on the status of our efforts to quantitatively determine both initial fluctuations and transport coefficients, as well as on recently developed ideas enabling a broad spectrum of novel types of analyses that demand both additional experimental measurements and new theoretical analysis methods.

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