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Simulating the start of inflation from inhomogeneous initial conditions

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A period of exponential expansion early in our cosmic history is usually
invoked to explain the large scale homogeneity and isotropy of the Universe.
However, there remain important questions about the conditions under which
inflation can actually start when homogeneity is not assumed to begin with it.
In this talk, I will present results from fully general-relativistic simulations used to understand the circumstances under
which a period of exponential expansion can eventually arise from initial
conditions where the gradient and kinetic energy of the putative inflaton dominates over
the potential energy. This allows us to study what happens in a number of different cases, both when using different inflaton potentials, as well as when considering a range of different scales for the inhomogeneities. In particular, we study the regime where the length scale of the inhomogeneities is comparable to the average Hubble radius, and where the gravitational pull of the over-densities is strong enough to form black holes.

Primary author: Dr EAST, William (Stanford University)

Co-authors: LINDE, Andrei (Stanford University); SENATORE, Leonardo (Stanford University); KLEBAN, Matthew (New York University)

Presenter: Dr EAST, William (Stanford University)

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