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Beginning inflation in an inhomogeneous universe WILLIAM EAST, KIPAC, Stanford University, MATTHEW KLEBAN, New York University, ANDREI LINDE, LEONARDO SENATORE, Stanford University — The idea that a period of exponential expansion occurred early in the Universe's history was originally proposed in order to explain the large scale homogeneity and isotropy of the Universe. However, there remain open questions about the conditions under which inflation can eventually arise when homogeneity is not assumed to begin with it. I will describe an investigation, utilizing simulations in full general relativity, of the very inhomogeneous regime where initially the gradient energy of the scalar inflaton field dominates over the potential energy, including the strong-field regime where the wavelength of the inhomogeneities are comparable to the Hubble radius, and black holes form. The results show that inflation can eventually arise from a general class of such initial conditions, at least as long as the the scalar field variations do not include values off the inflationary plateau. I will also comment on future directions for using the tools of numerical relativity to explore nonlinear and strong-field dynamics in cosmology.

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