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Non-equilibrium features in false vacuum decay at finite temperature

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False vacuum decay (aka first-order phase transition) in field theory at high temperature proceeds via formation of bubbles of new phase inside the old phase. This process has been extensively discussed in cosmology in relation to baryogenesis and as possible source of gravitational waves. It is traditionally described using the methods of statistical physics which rely on thermal equilibrium and do not capture the real-time dynamics. I will present the results of dynamical numerical simulations of thermal false vacuum decay in a classical scalar field theory. Tracking the bubble formation in real time reveals a number of non-equilibrium features such as oscillonic precursors and non-zero velocities of the bubbles. The decay rate happens to be suppressed compared to the equilibrium result. I will discuss a possible connection between the violation of equilibrium and slow thermalization of the system.

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