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Domain growth and fluctuations during quenched transition to quark-gluon plasma

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We model the initial confinement deconfinement transition in relativistic heavy-ion collisions as a rapid quench in view of expected rapid thermalization to a quark-gluon plasma state. The transition is studied using the Polyakov
loop model, with the initial field configuration (in the confining phase) covering a small neighborhood of the confining vacuum l= 0, as appropriate for
T < Tc. Quench is implemented by evolving this initial configuration
with the effective potential at a temperature T >Tc. We study the formation of Z(3) domain structure and its evolution during the transition as l rolls down in different directions from the top of the central hill in the effective
potential of l. When explicit Z(3) symmetry-breaking effects (arising from dynamical quark effects) are small, then we find well defined Z(3) domains, which coarsen in time. Remarkably, the magnitude plot of l shows vacuum bubble like configurations arising during the quench. This first-order transition like behavior occurs even though there is no metastable vacuum separated by a barrier from the true vacuum for the parameter values used.
When the initial field configuration everywhere rolls down roughly along the same direction (as will happen with large explicit symmetry breaking) then we do not find such bubble like configurations. However, in this case
we find huge oscillations of l with large length scales. We show that such large oscillations can lead to large fluctuations in the evolution of flow anisotropies compared to the equilibrium transition case.

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