Dissipation of Long-wavelength Pion and Sigma Modes in Heavy Ion Collisions

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Abstract

The dynamical evolution of long-wavelength Goldstone and sigma modes is investigated within the $O(N)$ model using linear response theory. Effective coarse-grained equations of motion of the chiral condensates are derived in the presence of a thermal bath. A careful analysis of the dissipative coefficients is performed by evaluating in a consistent manner the physical processes responsible for dissipation. In addition to the process of annihilation of pions into a sigma meson, the possible knocking out of pions due to tree-level scatterings of thermal pions and sigma mesons with the condensate are included. The field equations are solved in the phase of spontaneously broken symmetry for the expanding and cooling matter present in relativistic heavy ion collisions.

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