

Duration of classicality in degenerate quantum scalar fields

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We develop a formalism to help calculate in quantum field theory the departures from the description of a system by classical field equations. We apply the formalism to a homogeneous classical field with attractive contact interactions, to a homogeneous self-gravitating classical field in critical expansion and to an inhomogeneous classical field with repulsive contact interactions.

We show that, in a full quantum description, parametric resonance causes quanta to jump in pairs out of the classical condensate into all modes with wave vector within an instability window.

We calculate, in each case, the time scale over which the classical condensate is depleted and after which a classical description is invalid.

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