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Bubble wall dynamics from non equilibrium quantum field theory

Gravitational waves (GWs) produced during a first-order phase transition are a favourite candidate as a probe of beyond the standard model physics at future space-based experiments. The spectrum of produced GWs depends strongly on the terminal velocity at which bubbles of the broken phase expand in the plasma, and in particular on whether this velocity can become ultrarelativistic.
In this talk, I show how the language of non-equilibrium quantum field theory, together with the 2PI effective action, is the natural framework to study the dynamics of the bubble wall. I derive the full equation of motion for the bubble wall and the two-point functions, and show that it can be brought into a convenient form by expanding in gradients. This yields an equation that generalises the one usually employed.
In the ultrarelativistic regime, I compute the pressure induced by pair production of heavy particles, mixing with a heavy species and transition radiation of gauge bosons, thus providing a first-principle derivation of the known sources of friction.
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