Contribution ID : **3** Type : **not specified**

Bubble wall velocity from Kadanoff-Baym equations: fluid dynamics and microscopic interactions

Saturday, 27 September 2025 17:30 (30)

We establish a first principles, systematic framework for determining the bubble wall velocity during a first order cosmological phase transition. This framework, based on non-local Kadanoff-Baym equations, incorporates both macroscopic fluid dynamics and microscopic interactions between the bubble wall and particles in the plasma. Previous studies have generally focused on one of these two sources of friction pressure that govern the wall velocity. As a precursor, we utilize background field quantum field theory to obtain the relevant local Boltzmann equations, from which we derive the forces associated with variation of particle masses across the bubble wall and the microscopic wall-particle interactions. We subsequently show how these equations emerge from the Kadanoff-Baym framework under various approximations. We apply this framework in the ballistic regime to compute the new friction force arising from the $2 \to 2$ scattering processes in scalar field theory. We obtain a linear relationship between this force and the Lorentz factor γ_w that would preclude runaway bubbles with such effects.

Primary author(s) : ZHU, Jiang (Shanghai jiao tong univercity); RAMSEY-MUSOLF, Michael (TDLI-SJTU)

Presenter(s) : ZHU, Jiang (Shanghai jiao tong univercity)

Session Classification : Plenary