First principles determination of bubble wall velocity and local thermal equilibrium approximation

Tuesday 16 May 2023 10:45 (1h 15m)

In the first part of this talk, I will derive the fluid equations needed to compute the wall velocity from first principles. By treating the background and out-of-equilibrium perturbations in a consistent way, the resulting equations are free of the discontinuity at v_w=c_s that was observed in previous studies. I will show that the solutions can naturally be classified as deflagration/hybrid walls (v_w ~ c_s) or ultrarelativistic detonations. In the second part, I will explain how this calculation can be significantly simplified when local thermal equilibrium (LTE) is maintained in the plasma. Using this LTE assumption, the fluid equations can be reexpressed in terms of only four parameters that completely characterize a particle physics model. I will present an efficient algorithm to solve these equations and discuss the properties of their solutions. Finally, I will compute the kinetic energy fraction which is essential for predicting the gravitational wave spectrum produced during the phase transition.

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