

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

Saturday, 23 September 2023 16:00 (30 minutes)

I will briefly review the fluid equations needed to compute the wall velocity from first principles. As a concrete example, I will apply these equations to the singlet scalar extension of the Standard Model. The solutions obtained can naturally be classified as deflagration/hybrid walls ($v_w \sim c_s$) 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. Finally, I will discuss the properties of their solutions and compute the kinetic energy fraction which is essential for predicting the gravitational wave spectrum produced during the phase transition.

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