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Electroweak Bubble Wall Velocity

Tuesday, 6 December 2022 10:00 (1 hour)

It is important to understand the dynamics of Higgs-field bubbles during a cosmological phase transition, as they directly affect the production of various cosmological relics including the matter-antimatter asymmetry, topological defects, primordial magnetic fields, and especially a stochastic background of gravitational wave radiation. In this talk, I will present a recent work where we analyze Higgs condensate bubble expansion during a first-order electroweak phase transition in the early Universe. The interaction of particles with the bubble wall can be accompanied by the emission of multiple soft gauge bosons. When computed at fixed order in perturbation theory, this process exhibits large logarithmic enhancements which must be resummed to all orders when the wall velocity is large. We perform this resummation both analytically and numerically at leading logarithmic accuracy. The numerical simulation is achieved by means of a particle shower in the broken phase of the electroweak theory. The two approaches agree to the 10% level. For fast-moving walls, we find the scaling of the thermal pressure exerted against the wall to be P ~ γ^2T^4, independent of the particle masses, implying a significantly slower terminal velocity than previously suggested, which is especially impactful for the prediction of gravitational wave radiations.

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