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Bubble wall dynamics from nonequilibrium QFT

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First-order phase transitions (FOPT) in the early universe are a unique probe of physics beyond the Standard Model, playing a key role in electroweak baryogenesis and many different phenomena. Future gravitational wave detectors will allow us to see the signature of possible FOPT, but to extract theoretical value from it, we need a precise understanding of their dynamics. In this talk, I demonstrate how the language of non-equilibrium quantum field theory, together with the two-particle-irreducible effective action, offers a natural framework to describe the dynamics of a bubble after nucleation.
The arising picture captures all relevant fluid dynamics and quantum effects, thus unifying the existing frameworks for studying the bubble wall dynamics in all velocity regimes.

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