

量子物理学・ナノサイエンス第 444 回セミナー

Beyond Conventional Kibble-Zurek Physics

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概要

The Kibble–Zurek mechanism (KZM) combines Kibble’s observation of topological defects formation in cosmological phase transitions with Zurek’s theory relating their density to critical slowing down, and hence to the universality class of a second-order phase transition. The resulting KZM predicts defect density as a function of the quench rate in second-order phase transitions, in both classical and quantum settings. It has applications across a wide range of fields, including condensed matter physics, cosmology, and quantum computing.

In this talk, I will discuss extensions of KZM beyond its original formulation. I will show how KZM can be combined with nucleation theory to describe weakly first-order phase transitions, how nonadiabatic excitation formulas can be generalized to exotic quantum phase transitions, and how order-parameter dynamics offers a new perspective on KZM. I will also discuss how machine learning can provide deeper insight into second-order phase transitions beyond the conventional KZM framework.

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