

Rothkopf: Space-time symmetry preserving discretizations for classical field theory

Tuesday, 11 June 2024 14:00 (30 minutes)

In this talk I present the latest results [1] from a collaborative project, which develops novel discretization methods for field theory. Building on an analogy with the world-line formalism for point particle mechanics [2] we construct a novel action, in which coordinate maps participate as dynamical degrees of freedom, together with the propagating fields. In contrast to the conventional formulation of field theory, the action integral is formulated in terms of a set of $(d+1)$ abstract parameters on which both the fields and coordinate maps depend. We show that by discretizing the underlying parameters, the space-time coordinates remain continuous and thus can accommodate infinitesimal space-time transformations, which are the foundation of Noether's theorem. As long as a discretization is used that exactly mimics integration by parts in the discrete setting, the Noether charges remain exactly preserved. We illustrate the efficacy of the approach in $(1+1)d$ scalar wave propagation.

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