

## A Journey through Higher-Derivative Models in Contemporary Field Theory

With a initial motivation of treating point charge divergences in electrodynamics, higher-derivative (HD) models have come a long way in quantum in field theory passing through important challenges concerning their unitarity evolution and existence of propagating ghost fields. In modern physics, the relevance of HD models relies not only on abstract mathematical curiosities, but actually brings new possibilities for approaching open problems. In fact, since the 1950 well-known Pais-Uhlenbeck groundbreaking paper, models containing derivatives of order higher than two have abounded in the literature. In this talk, we briefly review and contextualize important HD models including Bopp-Podolsky, Lee-Wick, Pais-Uhlenbeck and HD Klein-Gordon generalizations while discussing their roles within recent new physics proposals. We present a consistently parametrized family of higher-order generalizations for the Klein-Gordon equation with their corresponding HD actions, illustrate the BRST quantization of the Pais-Uhlenbeck oscillator and discuss the null-plane dynamics and constraint structure of the Bopp-Podolsky model. We show that through the introduction of higher-derivatives, it is possible to generate massive modes for the fields whitout breaking gauge invariance. Different alternative interpretations are formulated concerning connections to the Pauli-Vilars regularization scheme, existence of new massive physical fields or disposal of consistent building blocks for constructions of larger relevant effective theories. We end with some remarks on the consistent reduction of order for higher-derivative models as recently presented in the literature.

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**Session Classification:** Contributed Talk

**Track Classification:** Contributed Talks