FONDAZIONE BRUNO KESSLER

ECT*
EUROPEAN CENTRE
FOR THEORETICAL STUDIES
IN NUCLEAR PHYSICS AND RELATED AREAS

**WORKSHOP**

**Trento, 27 - 31 May 2024**

# Machine Learning and the Renormalization Group

From stochastic annealing to diffusion models, the unreasonable effectiveness of physics concepts for the design of powerful machine learning algorithms has become increasingly apparent over the past two decades. Likewise, similarities between renormalization group transformations and neural networks are being explored for various applications, ranging from hierarchical models in computer vision to trivializing maps in lattice field theory. On the other hand, there has also been growing interest in the utilization of information bottleneck and quantum field theory techniques towards an improved theoretical understanding of the empirical successes of deep learning. Furthermore, exciting mathematical connections between functional renormalization group equations and optimal transport theory are being understood for the first time. This interdisciplinary workshop aims to provide an interface for experts from different fields sharing a common interest in this topic, with the goal of advancing our collective understanding and identifying promising directions for future work.

## Organizers

Julian Urban (MIT), Daniel Hackett (Fermilab), Anna Hasenfratz (University of Colorado Boulder), Jan Pawlowski (Heidelberg University), Biagio Lucini (Swansea Univesity)

## Keynote Speakers

Gert Aarts (Swansea University), Dimitrios Bachtis (École Normale Supérieure Paris), Miranda Cheng (University of Amsterdam), Nicolò Defenu (ETH Zürich), Harold Erbin (LIST Paris), James Halverson (Northeastern University), Kieran Holland (University of the Pacific), Friederike Ihssen (Heidelberg University), Maciej Koch-Janusz (University of Chicago), Anindita Maiti (Perimeter Institute), Misaki Ozawa (University Grenoble Alpes), Semon Rezchikov (Princeton University), Fernando Romero-Lopez (MIT), Jascha Sohl-Dickstein (Anthropic), Lingxiao Wang (FIAS), Urs Wenger (University of Bern), Sho Yaida (Meta AI), Kai Zhou (FIAS)

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