

# Bridging scales: At the Crossroads among Renormalisation Group, Multi-Scale Modelling, and Deep Learning

## Abstract

Machine learning will define the 21st Century: from simple image classification to text generation and decision-making, its impact on society will be nothing but immense. At present, the detailed mechanisms behind the power of AI still evade our understanding; growing evidence, however, suggests that it is possible to rationalise how deep learning works in terms that are very familiar to theoretical physicists, that is, the renormalisation group. The systematic, hierarchical coarsening of detailed information into increasingly simpler and more collective features is a cornerstone of modern physics, and it can be leveraged not only to make sense of machine learning's baffling capabilities, but also and most importantly to steer its development. This workshop will explore the area where the fields of soft and condensed matter, fundamental interactions, and deep learning overlap, looking for novel and more powerful tools to model, investigate, and understand the world around us.

## Organizers

- Roberto Menichetti (University of Trento & INFN-TIFPA) - Italy
- Francesco Pederiva (University of Trento & INFN-TIFPA) - Italy
- Raffaello Potestio (University of Trento & INFN-TIFPA) - Italy
- Alessandro Roggero (University of Trento & INFN-TIFPA) - Italy

## Keynote Speakers

Jean Barbier (ICTP Trieste), Tristan Bereau (Heidelberg University), Pietro Faccioli (University of Milan-Bicocca), Federica Gerace (SISSA Trieste), Alessandro Inghosso (ICTP Trieste), Andreas Ipp (TU Wien), Emanuele Locatelli (University of Padua), Alessio Lugnan (University of Trento), Di Luo (MIT), Yannick Meurice (University of Iowa), Sanghamitra Neogi (University of Colorado Boulder), Will Noid (Penn State), Christine Peter (University of Konstanz), Arnau Rios Huguet (University of Barcelona), Beatriz Seoane Bartolome (LISN, Paris-Saclay), Pratyush Tiwary (University of Maryland, College Park), Antonio Trovato (University of Padua), Luca Tubiana (University of Trento), Kai Zhou (CUHK-Shenzhen)

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