TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

Dipartimento di Fisica

European Research Council
Established by the European Commission

Seminar

Tuesday, 24 JUNE 2025 - h. 14:30

Sala Grassano (Dipartimento di Fisica)

Dr. Ludovico Giorgini

MIT, Boston, USA

"Response Theory via Score Modeling"

Abstract

Predicting how complex nonlinear systems respond to external perturbations is a central challenge. In this talk, I present a novel, data-driven framework that combines the Generalized Fluctuation–Dissipation Theorem with score modeling to estimate the response of nonlinear systems beyond traditional Gaussian approximations. This approach directly estimates the score function—i.e., the gradient of the invariant log-probability density—allowing accurate predictions of higher-order statistical responses. I will demonstrate the method's robustness and versatility across a range of applications: from low-dimensional models of climate variability and ENSO-like dynamics to stochastic PDEs including the Allen–Cahn and two-dimensional Navier–Stokes equations. Results show that this framework significantly improves upon classical techniques in capturing non-Gaussian features of system response, paving the way for more reliable data-driven predictions in climate science and beyond.

ERC-2019-ADG Grant N. 882340 "Smart-TURB"
(P.I. Prof. Luca Biferale)