



TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

Dipartimento di Fisica



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Seminar

Tuesday, 16 July 2024 - h. 14:00

Aula Fisica della Materia (Department of Physics)

Prof. Patricio Clark Di Leoni

Universidad de San Andrés

“Reduced Representations of Turbulent Rayleigh-Bénard Flows via Autoencoders”

Abstract

We analyzed the performance of Convolutional Autoencoders in generating reduced-order representations of Rayleigh-Bénard flows, with the aim of finding the smallest possible representations that still captures all relevant physics in the flow. We found that while at low Rayleigh numbers there is a clear minimum number of dimensions needed to compress up to the dissipation scale, at higher Rayleigh numbers the different, physics-based, metrics saturate at two different dimensions. At the lower dimension the autoencoder is able to represent up to mid-range scales and correctly estimate magnitudes such as the Nusselt number and the length of the boundary layer. At the higher dimension the autoencoders can represent up to the dissipation scale. We compare our architecture with two regularized variants as well as with linear methods. This study sets a path on how to proceed in finding the smallest possible representations of more and more turbulent flows.

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