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Tipo : **Talk**

De novo experiment design and experiment design optimisation in the era of foundation models

Progress in physics has long been driven by ingenious experiments conceived by human experts. Recently, AI-driven design methods have begun to move beyond tuning a handful of parameters to proposing entirely new experimental layouts. The discovered configurations often challenge established design conventions while matching or even exceeding the performance of human-designed setups.

This talk is based on two published papers and one follow-up paper that I hope to get out in time: in Eur. Phys. J. C 85, 1066 (2025) we frame the concept of intelligence and propose a hybrid intelligence and a framework for the development of hierarchical physics models that may be able to discover on their own new physics laws or concepts. In the other (Nature, <https://doi.org/10.1038/s41586-026-10898-6> , to appear on 3 September), we frame experimental design as a search for optima over a vast space of hardware configurations subject to practical constraints and provide a four-questions framework to make AI-driven design able to work on a spectrum from parameter tuning to de novo discovery, highlighting trade-offs between computational tractability, experimental feasibility, interpretability, and solution reliability.

We then argue that, ultimately, AI-designed experiments might thereby open new ways to explore the universe.

In the third paper, I will outline the validation requirements of such a pipeline.

Primary author(s) : VISCHIA, Pietro (Universidad de Oviedo)

Presenter(s) : VISCHIA, Pietro (Universidad de Oviedo)

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