

## **Abstract proposition – Ariel Days 2026 IAP**

### **Speeding up exoplanet atmospheres modeling with neural-network emulators.**

Characterizing exoplanetary atmospheres typically requires computationally intensive radiative transfer calculations to model their spectral signatures. This challenge is particularly acute for ground-based high-resolution spectroscopy ( $R \sim 50,000\text{--}100,000$ ), which relies on line-by-line calculations across broad spectral ranges. As a result, retrieving atmospheric properties for a single target often requires days of computation on dedicated clusters, necessitating simplified assumptions such as isothermal structures and constant abundance profiles at the expense of physical realism. Model emulation offers a promising solution by training neural networks to reproduce radiative transfer outputs at a fraction of the computational cost. In this talk, I will present our ongoing efforts to develop a neural-network-based emulator for the petitRADTRANS code, widely used in high-resolution spectroscopy studies, and discuss architectural choices and broader insights for surrogate modeling of complex physical systems.

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