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Bayesian Inferences of Neutron Stars' Properties: When Astro and Nuclear physics go hand in hand

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Understanding the equation of state (EoS) of dense matter is crucial in simulations of neutron star structure and dynamics, as well as for the interpretation of astrophysical data. In particular, the EoS of cold neutron stars defines their stationary structure, from their masses and radii to their tidal deformabilities and the oscillation spectra of their normal modes. However, a first-principles derivation remains out of reach across the density range relevant to neutron stars. To address this, Bayesian methods have been developed to explore nucleonic, hadronic, or agnostic EoS models constrained by theoretical, nuclear, and astrophysical inputs.
Gravitational wave signals from neutron stars encode information about their structure and, indirectly, their internal composition, offering a unique observational window for next-generation detectors like the Einstein Telescope. For this reason, Bayesian frameworks will be essential for extracting information from these observations and assessing the residual uncertainties in the EoS. In this seminar, I will present a causal "meta-model" for the EoS that systematically explores the nucleonic hypothesis and discusses its implications for neutron star structure and oscillation modes.

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Classification de Session: Compact Objects WG (GdR on Gravitational Waves)