

# Gravitational Geometry and Dynamics Group Seminar

Fri., May 15, 2026, at 11h00.

Room: Sala Sousa Pinto and Teams ID: 381 806 407 484 32

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## Binary boson stars: from initial data to gravitational wave signatures

Gravitational-wave (GW) observations have significantly advanced our understanding of stellar-origin compact objects. Current detectors could, in principle, also observe exotic compact objects (ECOs) acting as black-hole mimickers and interacting only gravitationally with visible matter. In this talk, we present a numerical-relativity study of eccentric mergers of equal-mass rotating  $\bar{m}=1$  Proca stars, focusing on their GW emission. In particular, we investigate how the internal phase structure of the Proca field affects the merger dynamics and the properties of the emitted signals, with the aim of identifying potentially distinctive observational signatures. Obtaining reliable waveforms for compact objects with non-trivial matter configurations, however, requires initial data that consistently satisfy the Einstein constraint equations. To address this issue, we employ the eXtended Conformally Flat Condition (XCFC) formalism to construct genuinely constraint-satisfying initial data for several scalar-field configurations. In particular, we show that this approach significantly improves upon the standard superposition of isolated solutions commonly used for boson star binaries, providing a more robust framework for numerical-relativity simulations of ECOs mergers.

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