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Looking for ultra-light scalars with gravitational-wave observations

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Ultra-light dark matter is an exciting alternative to the standard cold dark matter paradigm: it reproduces its large-scale (cosmological) predictions while solving most of its potential tension with small-scale (galactic) observations, like the “cusp-core” and “missing satellites” problems. If dark matter is made of some new ultra-light boson, dense structures are expected to form at the centre of galaxies (solitonic cores), or around compact objects (e.g., superradiant clouds, or DM spikes). These non-trivial environments may affect the sourcing and propagation of gravitational waves in compact binary coalescences, allowing near-future gravitational-wave observations to probe the nature of dark matter. In this talk, I will discuss some recent efforts on the modelling of black hole coalescences in ultralight dark matter environments: from numerical relativity simulations of mergers of equal-mass binaries to general-relativistic perturbative approaches to the evolution of extreme mass-ratio inspirals.

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