

# **Enlightening the dark Universe: Fundamental physics test through gravitational wave and electromagnetic observations**

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We already know that most of the observable Universe appears dark - from the dark energy that governs the expansion of our Universe, through the dark matter in the galaxies, to black holes where spacetime curvature reaches extreme values putting to test even Einstein's theory of gravity. Yet, we can only guess what else awaits to be discovered, whether new fundamental fields exist in nature, or strong gravity needs to be modified in its most extreme regime. The advances in electromagnetic and especially gravitational wave observations promise to unveil some of these mysteries. In the present talk, I will discuss some of the most interesting black hole and neutron star solutions beyond general relativity that allow us to dig deeper into our understanding of fundamental physics. Special attention will be paid to their astrophysical manifestations that can be tested observationally.