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Scalar-Induced Gravitational Waves and its impact in understanding cosmology

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Observations of gravitational waves (GW) from mergers of binary black holes has opened up a new door into cosmology. Due to their weak interaction with matter, we hope to observe Primordial GWs among the various signals that are expected from current and future-generation detectors. This offers a new and exciting opportunity to explore the physics of the early Universe. Quantum vacuum fluctuations are the standard generation mechanism and due to its quantum nature, Primordial GWs come in the form of a stochastic background (SGWB). One contribution to the latter arises from "scalar-induced"GWs (SIGWs), that are produced by second-order effects and coupling of scalar perturbations. Furthermore, the primordial fluctuations which produce SIGWs can additionally collapse to form primordial black holes (PBHs), providing a new channel to study their formations scenario and abundance.

In this talk I will briefly present the motivation to study SIGW. To understand the signature of SIGW that we can observe, I present our computations of the source term, first in a generic gauge and later by imposing the Newtonian gauge. In addition, we discuss how SIGW can be used to understand and probe both standard cosmology and beyond General Relativity, specifically considering modified gravity models. In particular we look at the effect of the modifications in the source term, considering the first-order corrections.

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