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LVK contribution on Gravitational Waves Physics

The first detection of GW in 2015 and the successful data recording campaigns of those last ten years have opened a new avenue for observing the Universe, studying general relativity and the fundamental interactions that govern it. GW detection constitutes a pillar of multimessenger astronomy in place today and for the 2030s.

The improved sensitivity of the LIGO-Virgo-KAGRA interferometers will increase the number of observed compact binary coalescence events and will give access to a deeper investigation of the merger and post-merger signals. It will also improve the source-localization ability, which is crucial for many of the scientific goals of gravitational-wave astronomy, such as electromagnetic follow-up and cosmology. Besides the detection of other events, new phenomena have still to be observed, such as stellar collapses, continuous signals from pulsars, and the gravitational-wave background of astrophysical origin.

If properly and timely upgraded, second generation GW detectors have the potential to significantly contribute to the achievement of high-priority scientific goals, at least till 2040s, when the third generation of instrument is supposed to start observations.

In this context, this document highlights the existing synergies between high-energy, nuclear and gravitational wave physics, as well as the importance of strengthening it in the coming years to meet these scientific challenges.

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