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Multi-messenger observations in the Einstein Telescope era: a scientific treasure chest to be unlocked

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The next generation of ground-based gravitational wave (GW) detectors is set to dramatically expand the horizon of observable GW sources in the few to 10^4 Hz frequency range. For compact binary mergers — binaries of stellar-mass black holes and neutron stars — this will translate to at least several high-confidence triggers per day. If a network of GW detectors will be operational alongside the Einstein Telescope (ET), the sky localisation of the loudest among these triggers could be exquisitely good (on GW standards), but the sky position of the majority of the sources will not be known to better than several tens of square degrees. Yet, the photometric and spectroscopic observation of these sources, starting as soon as possible after the merger, holds the potential to revolutionise our understanding of many branches of physics, including cosmology, nuclear physics, high-energy astrophysics, and massive stellar binary evolution. In this talk, I will highlight some of these science cases, delineating the requirements that the electromagnetic observations must satisfy in order to answer the underlying questions.

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