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Einstein Telescope and the next generation GW observatories: science, technologies and perspectives

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A new generation of gravitational wave (GW) observatories will pick up in the next decade; it will be the legacy of the current generation of GW detectors, Advanced LIGO and Advanced Virgo, allowing the exploration of almost the entire Universe through GW signals. Einstein Telescope (ET) in Europe and Cosmic Explorer (CE) in US are the pioneer projects aiming to the realisation of a 3rd generation Gravitational Wave Observatory. Benefiting of the momentum given by the scientific successes of the LIGO and Virgo detectors, ET had, in the last few years, important boosts toward its realisation entering in several national and international roadmaps and receiving the support of many European agencies. ET and CE, working together and/or standalone, will be simultaneously new discovery and precision measurement observatories; they have a rich variety of scientific and multidisciplinary targets in astrophysics, nuclear physics, fundamental physics and cosmology. In fact, for example, ET aims to investigate almost the whole Universe, up to the dark ages, through the coalescence of stellar and intermediate mass black holes; it will detect and measure in great detail the gravitational wave signal generated by hundreds of thousands coalescences of neutron stars per year, revealing the nuclear physics governing this kind of stars. ET will be also a technological challenge: in order to achieve the expected sensitivity a new underground research infrastructure will be realised, a multi-interferometer per detector design will be implemented hosting new or updated technologies studied to reduce the noises limiting the current detectors. An overview of the ET observatory science targets, of the observatory design, of the needed technologies and project organisation, will be presented.

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