COLLOQUIA

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From LIGO-Virgo to Einstein Telescope: the present and the future of Earth-based gravitational wave detectors and observations

Abstract

Gravitational waves (GWs) are the newest tool for exploring the Universe. Advanced Virgo and Advanced LIGO have opened a new window on the Universe, detecting about 100 GW signals in the Hz-kHz frequency range since 2015 and through three different observing runs. The fourth one has just started, with the addition of the KAGRA detector. During the past years, several upgrades have improved the sensitivity and the observational frequency window of these detectors. They have challenged our present capabilities, placing these detectors at the outermost technological and scientific frontiers.

A new generation of GW interferometric observatories on the Earth and in space is under preparation and will take over from the current generation of GW detectors in the next decade.

This will make it possible to probe almost the entire Universe for GW signals. The Einstein Telescope (ET) is at the forefront of the design, preparation and realisation of a next-generation gravitational wave terrestrial observatory in Europe.

In the first part of this four-handed seminar, past GW observations, as well as the present status of current detectors and their expected performances, will be discussed.

This discussion will move on to an overview of the future updates of LIGO, VIRGO and KAGRA detectors, in relation to the advent of the next generation Earth-based detectors, such as Cosmic Explorer or ET.

In the second part of the seminar, an overview of the scientific objectives, the observatory design, the required technologies and the project organization of ET will be presented.

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