

Subject : Gravitational Wave Astronomy

Title : Recent developments in gravitational wave astronomy

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Outline : Since the first direct detection of gravitational waves in 2015, the field of GW astronomy has expanded rapidly. So far, 90 GW events have been officially announced, which include not only blackhole collisions, but also mergers of neutron stars and coalescences of blackhole-neutron star binaries. These observations are revealing previously uncharted territories of the Universe not reachable with electro-magnetic observations. In Japan, a large-scale cryogenic GW detector KAGRA was constructed in Hida city in Gifu prefecture and it joined the currently on-going observation run, called O4, with LIGO and Virgo in 2023. In this lecture, I will introduce recent important discoveries of GW astronomy as well as the challenges of developing ultra-sensitive gravitational wave detectors.

Learning objectives :

1. Understand recent achievements of GW astronomy
2. Understand expected astronomical results from future GW observations
3. Understand the principle of a GW detector and its technical challenges

Textbooks and references :

「A First Course in General Relativity」 Bernald Schutz, Cambridge University Press (2009)

「Gravitational-Wave Physics and Astronomy」 Jolien D. E. Creighton and Warren G. Anderson, WILEY-VCH (2011)

「Handbook of Gravitational Wave Astronomy」 Cosimo Bambi, Stavros Katsanevas Konstantinos D. Kokkotas, Springer (2021)