Exploration of Other Destinations (5)
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Author: Prof.Dr. RAJESH KUMAR DUBEY
Lovely Professional University, India, professordubey@gmail.com

GRAVITATIONAL WAVES FOR MEASURING HUBBLE'S CONSTANT IN THE ACCELERATING UNIVERSE

Abstract

Gravitational Waves for Measuring Hubble's Constant in the Accelerating Universe There could be different ways for observations and calculations for Hubble's Constant. These methods primarily include estimation from the cosmic microwave background and measurement from distance ladder using standard sirens. After the detection of Gravitational Waves and the modern technology for their advanced sensitivity, the measurement of Hubble's Constant has attained a new platform. The detection of GW170817 in both gravitational waves and electromagnetic waves heralds the age of gravitational-wave multi-messenger astronomy. On 17 August 2017 the Advanced Laser Interferometer Gravitational-wave Observatory (LIGO) and Virgo detectors observed GW170817, a strong signal from the merger of a binary neutron-star system. Less than 2 seconds after the merger, a gamma-ray burst (GRB170817A) was detected within a region of the sky consistent with the LIGO-Virgo-derived location of the gravitational-wave source. This sky region was subsequently observed by optical astronomy facilities resulting in the identification of an optical transient signal within 10 arc sec of the galaxy NGC4993 These multi-messenger observations allow to use GW170817 as a standard siren the gravitational-wave analog of an astronomical standard candle , to measure the Hubble constant. This quantity, which represents the local expansion rate of the Universe, sets the overall scale of the Universe and is of fundamental importance to cosmology. This measurement combines the distance to the source inferred purely from the gravitational-wave signal with the recession velocity inferred from measurements of the redshift using electromagnetic data. This approach does not require any form of cosmic "distance ladder"; the gravitational-wave (GW) analysis can be used to estimate the luminosity distance out to cosmological scales directly, without the use of intermediate astronomical distance measurements. Additional standard-siren measurements from future gravitational-wave sources will provide precision constraints of this important cosmological parameter.