PROSPECTS FOR GRAVITATIONAL-WAVE POLARIZATION TEST FROM COMPACT BINARY COALESCENCES WITH NEXT-GENERATION DETECTORS

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There are six tensorial and nontensorial possible polarization modes of gravitational waves in general metric theory of gravity, while general relativity allows only two tensor polarization modes [1]. The properties and number of polarization modes depend on specific gravity theories. The number of the detectors needs to be equal to the number of the polarizations of the gravitational waves to separate polarization modes [2]. However, a single detector having extended lower frequency sensitivity could be effectively regarded as a virtual detector network including a set of detectors along its trajectory due to a long signal from a compact binary coalescences and the Earth rotation [3]. Thus, time-dependent antenna pattern functions can help testing the polarizations of gravitational waves. We study separability of polarizations, the effect of the Earth rotation in the polarization test, and prospects for gravitational-wave polarization test from compact binary coalescences with next-generation detectors such as Einstein telescope [4] and Cosmic Explorer [5]. We show that it would be possible to test the polarizations by the future observations of binary systems with accuracy comparable to the current constraints on the amplitude for nontensorial modes from the observations of PSR B1913+16 in a much stronger regime of gravity.

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