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Gravitational waves of GUT phase transition during inflation

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Grand unified theory (GUT) phase transition is generally considered unobservable due to its ultrahigh energy scale, and the monopole problem associated with GUT phase transition is one motivation of inflation. We propose that if a first-order GUT phase transition happens during inflation, the induced gravitational waves (GWs) are redshifted and deformed, and might be observed today in GW observatories. We review the formalism of inflated GWs and derive the general deformation function between inflated and uninflated GW spectra in the instant-source or transitory-source application. It is valid for any e-folding number of instant or transitory source. Applying the formalism to GUT phase transition, we find that the e-folding number at 15 or 25 can shift the GWs to 10 Hz or mHz hands, respectively, which might be tested in the future ground-based or space-based interferometers. We further generalise the discussion to inflated GWs via phase transition below the GUT scale. It is worth mentioning that, due to the deformation of the spectrum, the peak of inflated GWs is not simply a redshift of the peak of uninflated GWs.

Collaboration you are representing

Authors: HU, Xi-He (HIAS, UCAS); ZHOU, Ye-Ling (HIAS-UCAS)

Presenter: HU, Xi-He (HIAS, UCAS)

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