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The cosmological impact of future constraints on H_0 from gravitational-wave standard sirens

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Gravitational-wave standard sirens present a novel approach for the determination of the Hubble constant. After the recent spectacular confirmation of the method thanks to GW170817 and its optical counterpart, additional standard siren measurements from future gravitational-wave sources are expected to constrain the Hubble constant to high accuracy. At the same time, improved constraints are expected from observations of cosmic microwave background (CMB) polarization and from baryon acoustic oscillations (BAO) surveys. We explore the role of future standard siren constraints on H_0 in light of expected CMB+BAO data.
Considering a 10-parameters cosmological model, in which curvature, the dark energy equation of state, and the Hubble constant are unbounded by CMB observations, we find that a combination of future CMB+BAO data will constrain the Hubble parameter to $\sim 1.5\%$. Further extending the parameter space to a time-varying dark energy equation of state, we find that future CMB+BAO constraints on H_0 are relaxed to $\sim 3.0\%$. These accuracies are within reach of future standard siren measurements from the Hanford-Livingston-Virgo and the Hanford-Livingston-Virgo-Japan-India networks of interferometers, showing the cosmological relevance of these sources. If future gravitational-wave standard siren measurements reach 1% on H_0, as expected, they would significantly improve future CMB+BAO constraints on curvature and on the dark energy equation of state by up to a factor ~ 3. We also show that the inclusion of H_0 constraints from gravitational-wave standard sirens could result in a reduction of the dark energy figure-of-merit (i.e., the cosmological parameter volume) by up to a factor of ~ 400.

Summary

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