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First measurement of the Hubble constant from gravitational wave-galaxy cross-correlations

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We measure for the first time the Hubble constant (H_0) from the cross-correlation of galaxies and gravitational waves (GW), by applying the Peak Sirens method. This method consists of finding the peak of the 3D angular cross-spectrum $C_\ell(z, D_L)$ between the galaxy redshifts (z) and the GW luminosity distances (D_L). Using two GW events from the GWTC-3.0 catalog and the GLADE+ galaxy catalog, we make the first detection of the cross-correlation peak at 5.9σ confidence. This signal comes mostly from the best localized event in the catalog, GW190814, which alone provides a 3.4σ significance. Adding also the multimessenger event GW170817, but without using its known redshift, we find $H_0 = 67^{+18}_{-15} \text{ km s}^{-1} \text{ Mpc}^{-1}$ and the first observational constraint on the GW bias, $b_{gw} < 4.3$ at 95% CI. These measurements set the stage for future novel cosmological constraints with this technique.

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