LIGO researchers suggest background noise due to gravity waves may be much greater than thought

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An aerial view of the Laser Interferometer Gravitational-wave Observatory (LIGO) detector in Livingston, Louisiana. LIGO has two detectors: one in Livingston and the other in Hanaford, Washington. LIGO is funded by NSF; Caltech and MIT conceived, built and operate the laboratories. Credit: LIGO Laboratory

(Phys.org)—The research team working with the LIGO project has proposed that the data gleaned from the discovery of gravity waves last year allows for calculating the likely level of cosmic background noise due to gravitational waves, and that it is much greater than previous models have suggested. In their paper published in *Physical Review Letters*, researchers with the LIGO Scientific Collaboration along with a companion group from the Virgo Collaboration, describe their reasoning behind their estimates and why they believe they will be able to offer more support for their theory within just a few years.

Prior to the landmark experiments that led to the detection of gravitational waves, researchers believed that there was likely a very nearly constant stream of background gravitational noise moving through the cosmos, generated by black holes and neutron stars merging, but had lacked any physical data that might allow them to estimate how much background noise might exist. With the detection of the gravitational waves that resulted from the merger of two binary black holes, the researchers suddenly found themselves with actual concrete data, which they have now used as a basis for calculating the likely amount of gravitational wave noise constantly bombarding our planet.

To make predictions based on data from just one event, the team started with the assumption that the event that was measured was not one that was out of the ordinary—that allowed for making energy density estimates for all possible black hole binaries, based on the energy density of the black holes involved in the merger that was observed—and that in turn allowed for calculating estimates of the amount of gravitational radiation that would occur due to black holes merging. Next, they used the masses of the black holes that were observed to merge to calculate the likely true distribution regarding the number of black hole binaries in existence—this was possible because they placed the observed merger black holes in the middle of a bell curve. Doing so, the team reports, indicated that there are likely 20 times as many black hole binaries out there as has been estimated, which suggests that there is likely 10 times as much gravitational noise than has been suspected.

The team acknowledges that because their results are based on a data from just one event, their conclusions could be wrong, but, if they are right, they note, they should be able to detect them within just the next five years or so as the LIGO and Virgo detectors grow to full strength.

More information: B. P. Abbott et al. GW150914: Implications for the Stochastic Gravitational-Wave Background from Binary Black Holes, *Physical Review Letters* (2016). DOI: 10.1103/PhysRevLett.116.131102 , On *Arxiv*: arxiv.org/abs/1602.03847

Abstract
The LIGO detection of the gravitational wave transient GW150914, from the inspiral and merger of two black holes with masses ?30M?, suggests a population of binary black holes with relatively high mass. This observation implies that the stochastic gravitational-wave background from binary black holes, created from the incoherent superposition of all the merging binaries in the Universe, could be higher than previously expected. Using the properties of GW150914, we estimate the energy density of such a background from binary black holes. In the most sensitive part of the Advanced LIGO and Advanced Virgo band for stochastic backgrounds (near 25 Hz), we predict $?_{GW}$(f=25 Hz)=$1.1^{+2.7}_{?0.9}\times10^{?9}$ with 90% confidence. This prediction is robustly demonstrated for a variety of formation scenarios with different parameters. The differences between models are small compared to the statistical uncertainty arising from the currently poorly constrained local coalescence rate. We conclude that this background is potentially measurable by the Advanced LIGO and Advanced Virgo detectors operating at their projected final sensitivity.