Background space hum may reveal hidden black holes

An artist's rendering showing two merging black holes similar to those detected by LIGO | Photo Credit: REUTERS

Scientists have developed a new technology that can listen to background humming of deep space and unveil thousands of hidden black hole collisions missed by gravitational-wave detectors.

Deep space is not as silent as we have been led to believe. Every few minutes a pair of black holes smash into each other. These cataclysms release ripples in the fabric of spacetime known as gravitational waves.

The gravitational waves from black hole mergers imprint a distinctive whooping sound in the data collected by gravitational-wave detectors. The new technique developed by researchers from Monash University in Australia is expected to reveal the presence of thousands of previously hidden black holes by teasing out their faint whoops from a sea of static.

Last year, in one of the biggest astronomical discoveries of the 21st century, LIGO Scientific Collaboration (LSC) and Virgo Collaboration researchers measured gravitational waves from a pair of merging neutron stars. To date, there have been six confirmed, or gold plated, gravitational-wave events announced by the LIGO and Virgo Collaborations. However there are more than 100,000 gravitational wave events every year too faint for LIGO and Virgo to unambiguously detect, according to Eric Thrane from the ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav).

The gravitational waves from these mergers combine to create a gravitational-wave background. While the individual events that contribute to it cannot be resolved individually, researchers have sought for years to detect this quiet gravitational-wave hum.

Researchers have developed a new, more sensitive way of searching for the gravitational-wave background. “Measuring the gravitational-wave background will allow us to study populations of black holes at vast distances. Someday, the technique may enable us to see gravitational waves from the Big Bang, hidden behind gravitational waves from black holes and neutron stars,” Thrane said.

The researchers developed computer simulations of faint black hole signals, collecting masses of data until they were convinced that — within the simulated data — was faint, but unambiguous evidence of black hole mergers. Researchers are optimistic that the method will yield a detection when applied to real data.

Recent improvements in data analysis will enable the detection of what people had spent decades looking for, they said. The new method is estimated to be one thousand times more sensitive, which should bring the long-sought goal within reach. The study was recently published in *Physical Review X*.

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