Stephen Hawking was right: Black holes never shrink.

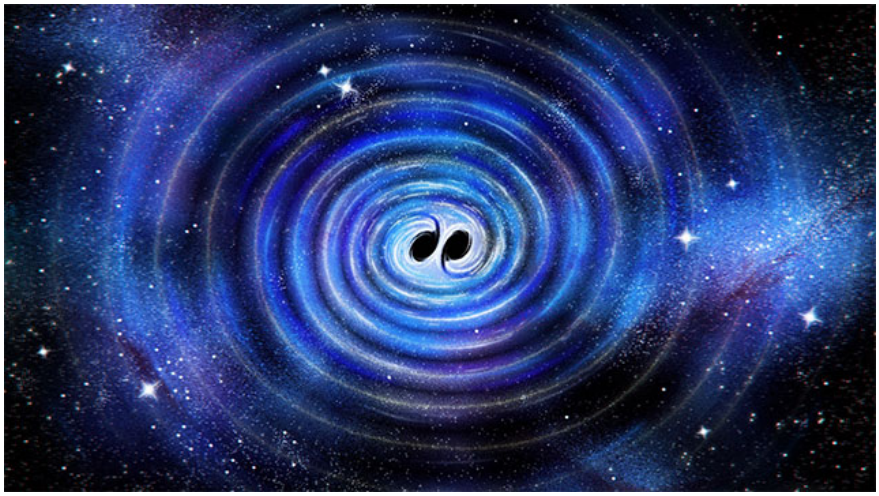
Record-breaking high-resolution gravitational wave observations show that the merged black hole cannot shrink, just as Stephen Hawking predicted, and also confirms the Kerr black hole model in Einstein's theory of relativity.

Ten years after the first gravitational waves were detected from the collision of two black holes, the LIGO–Virgo–KAGRA collaboration—which includes renowned astronomer Maximiliano Isi of Columbia University—has recorded another signal from a nearly identical cosmic event.

Thanks to major improvements in the sensitivity of the detection system, the research team observed the collision with nearly four times the clarity they had previously. The new data helped them confirm two important theoretical predictions:

1. Black holes formed after mergers **never shrink** , just as Stephen Hawking's theory predicted.
2. Black holes will **vibrate** after merging, just as Einstein's theory of general relativity predicted.

"The extremely clear signal from this GW250114 black hole merger allows us to test some of the most important hypotheses about black holes and gravitational waves," Isi shared.



Verifying Hawking's 'Law of Area'

In 1971, Stephen Hawking proposed that the event horizon—the outer boundary from which nothing can escape— **never diminishes in size.**

In 2021, Isi and his colleagues used data from the LIGO observatory to analyze the ripples in spacetime generated by a black hole collision, providing the first observational evidence to confirm that prediction. At the time, *The New York Times* commented that if these results had been published before Hawking's death, he might have received the Nobel Prize.

The new results further reinforce that conclusion with much greater accuracy: the surface area of ??the merged black hole **is always greater than or at least equal to the sum of the surfaces of the two original black holes** . This significant improvement was achieved thanks to data collected simultaneously from the two LIGO facilities in Washington and Louisiana.

The research team also isolated and analyzed the gravitational waves emitted when the black hole merged. By measuring the pitch and duration of these ripples, they were able to better determine the structure and properties of the newly formed black hole. This mechanism is similar to listening to the sound emanating from a hollow musical instrument to determine its size, material, and the forces at work.

The results show that the merged black hole fits the description of **the Kerr black hole** — a mathematical model developed by mathematician Roy Kerr in the 1960s that accurately solves Einstein's space-time equations.

Physicists have long believed that all black holes obey Kerr's solution, but confirming this through observation has been extremely difficult. This particularly clear signal provides the most direct evidence to date that black holes do indeed behave as Kerr predicted.

"Over the next decade, gravitational wave observatories like LIGO will continue to be upgraded, allowing us to see even more clearly the mysteries of black holes ," Isi shared. " *I'm very excited to see what we will discover.* "