
Breaking Comments
Fatal crash on I-93



For the first time, the universe is heard



JULIAN STRATENSCHULTE/EPA

A scientist in Germany was silhouetted by a visualization of the waves, discovered by a team of physicists led by MIT and Caltech. Above, notes related to Albert Einstein's prediction of the interstellar sounds.

By **David Abel** | GLOBE STAFF FEBRUARY 12, 2016

About 1.3 billion years ago, after circling each other for eons in the distant universe, two massive black holes collided with unimaginable force. The explosion was more powerful than the light in all the visible stars of the

cosmos, and it sent a shudder through the fabric of space and time.

At 5:51 a.m. on Sept. 14, a new, highly advanced observatory in Louisiana heard the explosion as it passed the Earth in ripples known as gravitational waves, a high-pitched chirp in the steady hum of the universe. Seven milliseconds later, the distinct sound was registered at a sister observatory in Washington.

The landmark discovery, by a team led by physicists from the Massachusetts Institute of Technology and the California Institute of Technology, marked the first time scientists had detected gravitational waves, confirming a central prediction that Albert Einstein made 100 years ago in his general theory of relativity.

The event was confirmed publicly Thursday: scientists hope the discovery may ultimately provide a clearer picture of how the universe began.

“For the first time, we’ve been able to listen to the sounds that the universe has been transmitting to us from the beginning of time,” said Nergis Mavalvala, an MIT physics professor who played a major role in the research. “By now being able to detect gravitational waves and light from the same systems, we can get a much better, complete picture of the universe.”

Mavalvala and others likened the discovery, made public in the journal *Physical Review Letters*, to the moment silent movies added sound. Until now, scientists have depended mainly on light to understand the universe; now they will be able to learn far more by being able to listen to it, and to study the way the gravitational waves course through space.

Scientists have been working for decades to confirm the presence of gravitational waves. But repeated efforts to detect them have failed.

Last year, a team of astronomers retracted a paper in which they claimed to have detected gravitational waves emanating from the moment of the Big Bang. To great fanfare, the team heralded the discovery as evidence that the universe began to expand with a colossal explosion, but later said their measurements had been marred by some kind of interstellar dust.

The new discovery, based on the work of 1,000 scientists across the United States and in 14 countries, relied on recent upgrades to observatories in Livingston, La., and Hanford, Wash., that use lasers beamed across 2.5 miles inside specialized tubes.

The Laser Interferometer Gravitational Wave Observatories, built and designed by scientists at MIT and Caltech and funded by the National Science Foundation, use special mirrors to detect microscopic changes in motion.

The precision of the equipment, their location on Earth, and the long distance separating them makes the discovery far more reliable than previous claims involving gravitational waves, said Matt Evans, an assistant professor of physics at MIT.

“The history of this field is littered with many mistakes, and we needed to be very careful,” he said. “Because we detected them at the same time in two places, it’s unlikely that there would be strange instrumental distortions.”

He compared the instruments to giving powerful hearing aids to a person who is deaf.

“We’re really just starting to hear now,” he said. “That makes this a game-changer.”

He said the discovery also confirmed the presence of the two massive black holes, which the team estimated to be about 29 times and 36 times the mass of the sun. As a result, they also now know there are stars as large as 100 times the mass of the sun, which they believe were formed shortly after the Big Bang.

The discovery stems from Einstein’s theories that black holes, which are formed when massive stars collapse, gradually approach each other over billions of years. At a certain point, they converge with great velocity — nearly half the speed of light — and release enormous amounts of energy through gravitational waves, as they merge into one massive black hole.

“With this discovery, we humans are embarking on a marvelous new quest: the quest to explore the warped side of the universe — objects and phenomena that are made from warped spacetime,” said Kip Thorne, a physics professor at Caltech. “Colliding black holes and gravitational waves are our first beautiful examples.”

At a news conference Thursday morning in Cambridge, MIT president L. Rafael Reif attributed the discovery to scientists across several generations and called it “a truly scientific triumph.”

“They have opened a whole new field of inquiry, so knowledge will keep on advancing,” he said.

The physicists said they continue to analyze data from the initial discovery, and hinted they could have more significant news to announce in the coming year. The team plans to continue using the observatories to test other theories associated with general relativity and search for other sources of gravitational waves.

The observatories may allow them to see even further back in time than the most sophisticated telescopes. One researcher noted that light didn’t escape the Big Bang for some 400,000 years, but gravitational waves were emitted within a fraction of a second of that explosive burst of creation.

“This is going to be the next big thing in astrophysics,” said Erik Katsavounidis, an associate professor of physics. “It’s going to be a revolution.”

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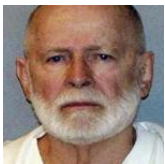
The couple allege in the lawsuit that Aisling Brady McCarthy is responsible for the 2013 death of their 1-year-old girl. [MORE...](#)



ADRIAN WALKER

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president of the women's college in July. [MORE...](#)



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Octogenarian marijuana kingpin's sentencing postponed

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Former mayor Ray Flynn in car accident, not injured

Former mayor Ray Flynn was in a car accident Thursday while driving near his home in South Boston, but was not injured, the city said. [MORE...](#)



Officials vow to protect East Boston after gang slayings

Mayor Martin J. Walsh pledged during a public meeting in East Boston on Thursday night to work to protect the neighborhood. [MORE...](#)



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Robert F. Kennedy saw conspiracy in JFK's assassination

Robert F. Kennedy took on some of the Kennedy Administration's hardest tasks, ones that created dangerous foes, and after the assassination, RFK wondered if one of them had done it. [MORE...](#)



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Marion Mainwaring, 93; scholar completed Wharton's novel

“I think it surprised her how popular the book became,” said her nephew. Of the



critical response, he said: “I think if anything that probably amused Marion.” [MORE...](#)

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Colleges like Harvard are being asked whether their stockpiling of wealth befits their special tax status. [MORE...](#)

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