Explosion might have rocked space itself, scientists claim

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Courtesy of
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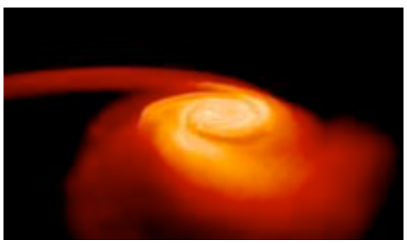
Astronomers searching for an exotic type of ripple in the very fabric of space and time say a distant blast creating such waves may have already been detected.

Although no instruments existed at the time that could have picked up the much-sought "gravitational waves," the explosion reported in 1987 may nonetheless have created them, two scientists claim. They theorize that in the future, observations of similar explosions could help confirm proposed findings of gravitational waves.



A simulation of material being ejected from a star merger. (Credit: Stephan Rosswog)

Albert Einstein proposed the existence of the waves, and we're still looking for them: ripples in space-time that are in a sense the sounds of our universe. Just as sound—which consists of ripples in the air or other material—complements vision in daily life, gravitational waves are expected to complement our view of the universe taken by standard telescopes. Advanced gravitational wave detectors are being built in the U.S., Europe, Japan and Australia.

In theory, any motion produces gravitational waves. But a signal loud enough to be detected requires two huge masses to collide very, very fast. The prime candidate sources are mergers of two neutron stars: objects, each with a weight comparable to that of our sun, that spiral around each other, then crash together at nearly light speed.

Such events are calculated to take place only once every several hundred thousand years in a given galaxy. So to detect a signal within our lifetime, the detectors must be sensitive enough to detect them out to distances of a billion light years away from Earth, researchers say. A light year is the distance light travels in a year.

Such a search poses an immense technological challenge: at such distances, the gravitational wave signal would sound like a faint knock on our door when a TV set is turned on and a phone

rings at the same time. Competing noise sources are many, ranging from seismic noise produce by tiny quakes or even a distant ocean wave. How can we know we've detected a gravitational wave from space rather than a falling tree or a rambling truck?

Thus astronomers have been looking for years for a light signal that might accompany or follow gravitational waves. This signal would allow us to "look through the peephole" after hearing the faint knock on the door, and verify that indeed something is there, according to the two Israeli researchers who describe their investigations into the topic in a new new paper in the research journal *Nature.*

The scientists, Tsvi Piran of Hebrew University of Jerusalem and Ehud Nakar of Tel Aviv University, suggest that such a signal may already have been noticed years ago.

Piran and Nakar contend that that gas and dust surrounding the colliding objects would slow debris ejected at velocities close to light speed during neutron star mergers. Heat generated during this process would radiate outward as radio waves. The resulting radio flare would last a few months and would be detectable with current radio telescopes from a billion light years away, according to the researchers.

Search after such a radio signal would take place following a future detection, or even a tentative detection of gravitational waves. But even before the advanced gravitational wave detectors become operational, as expected in 2015, radio astronomers are geared to looking for these unique flares.

Nakar and Piran say an unidentified "radio transient" source reported in 1987 by Geoffrey Bower of the University of California, Berkeley, and colleagues has all the characteristics of such a flare. A radio transient is an unusual astronomical object or event that gives off radio emissions for a few months or less, and is generally believed to mark some sort of explosion or violent process. The one seen by Bower's group may have been the first direct detection of a neutron star binary merger resulting in gravitational waves, according to Piran and colleagues.