AN ILLUMINATING COSMIC COLLISION

By **Keith T. Smith**

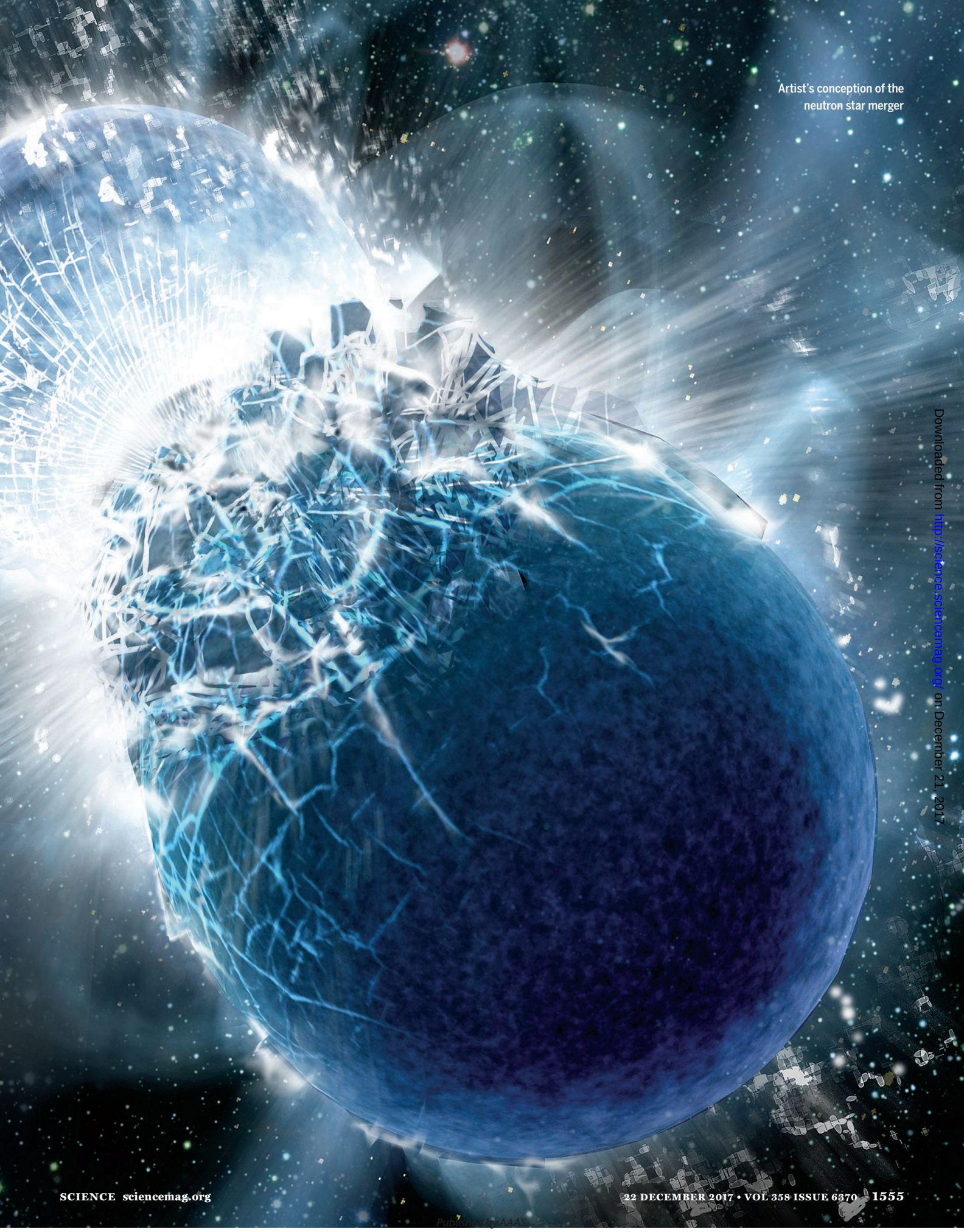
The gravitational wave event GW170817—detected by the Laser Interferometer Gravitational-Wave Observatory (LIGO) and named after the date that it occurred—was swiftly identified as the merger of two neutron stars. Unlike previously detected black hole mergers, theoretical models predicted that merging neutron stars should emit electromagnetic radiation, potentially detectable by conventional astronomical telescopes. The race was on to find the electromagnetic counterpart before it faded away.

Combined data from the two LIGO detectors and the Virgo interferometer showed that the source was located somewhere in a 31-square-degree patch of sky. That's 150 times the size of the full Moon—a large area to search blindly. A coincident gamma-ray burst was also detected, but that did not improve the direction constraint. However, the interferometers provided another crucial piece of information: the approximate distance. Cross-matching the direction and distance with catalogs of known galaxies narrowed the search to about 100 possible locations.

The search took less than an hour of nighttime observing, after waiting hours for the Sun to go down. A bright, but rapidly fading, new source in the galaxy NGC 4993 was quickly found using an optical telescope. Numerous other observatories then swung into action: Over the following weeks, dozens of teams used 70 separate telescopes to study the event. The papers in this section describe many of those observations, covering the electromagnetic spectrum from x-rays to radio waves, and interpret them as an explosion generated by the merger, known as a kilonova.

The scientific bonanza from GW170817 was enabled by the sensitivity of the gravitational wave interferometers, coupled with the rapid response from time-domain astronomers. The partnership of these two communities holds great promise for new discoveries.

ILLUSTRATION: DANA BERRY/HARVARD-SMITHSONIAN CFA



Artist's conception of the neutron star merger

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