wave detectors now under construction.

Finn's study, detailed in the Oct. 3 PHYSICAL REVIEW LETTERS, examines existing data on four pairs of neutron stars. One star in each pair acts as a celestial lighthouse, beaming radio waves toward Earth at intervals so precise it rivals the steadiness of the best atomic clocks. Tightly bound by gravity, the other neutron star betrays its presence by periodically delaying or advancing the arrival of the radio signals beamed by the first.

Using radio telescopes to detect the signals, astronomers have determined the mass of each member of the neutron-star duos. All of them seem to be about 1.4 times as massive as the sun.

The four pairs represent a tiny fraction of the total number of neutron stars thought to have other neutron stars as partners. But according to Finn, his analysis of this small sample reveals with high statistical certainty that all binary neutron stars range between 1.01 and 1.6 times the mass of the sun.

The finding has several implications, Finn notes. One possibility is that nature's way of making neutron stars, typically in a supernova explosion, may simply not permit them to have more mass than his analysis indicates — whether or not they have a partner. In that case, the restricted mass range could help fine-tune theories about neutron-star formation, Finn says. Alternatively, he notes, the mass limits may not apply to neutron stars that lack a partner. However, scientists have no way of measuring the mass of isolated neutron stars.

The mass limits have additional significance, Finn says. The collision of two neutron stars represents a key source of gravity waves sought by the laser interferometer gravitational wave observatory (LIGO). This pair of detectors, to be located near Livingston, La., and in Hanford, Wash., is slated for completion in 1999. The intensity of the waves depends largely on the mass of the neutron stars, and "of all the sources of gravitational radiation that we can anticipate, this is the one that LIGO is most likely to see," he says. *—R. Cowen*

Making light of sound in solitary bubbles

Trapped in an intense sound wave, a tiny gas bubble in water can emit a string of flashes bright enough to be visible in an undarkened room. Producing a startling sound-and-light show on an intriguingly small scale, this simple system serves as a remarkable microlaboratory for physics and chemistry.

Now, researchers have demonstrated that slight changes in the composition of the gas inside such a bubble can strongly influence the intensity and wavelengths of the light that escapes. For example, adding a small amount of argon, xenon, or helium to a nitrogen bubble substantially increases the intensity of ultraviolet light emission.

Physicists Robert Hiller, Keith Weninger, Seth J. Putterman, and Bradley P. Barber of the University of California, Los Angeles, describe their findings in the Oct. 14 SCIENCE.

When an intense sound beam travels through water, it creates microscopic cavities that immediately fill with gas originally dissolved in the liquid. Such bubbles alternately expand and contract in step with regular changes in the sound wave's pressure.

During the contraction phase, a bubble can collapse so violently and rapidly that it concentrates the sound energy sufficiently to heat the enclosed gas to temperatures exceeding 10,000 kelvins. The heated gas luminesces, giving off an extremely bright flash of visible and ultraviolet light lasting less than 50 picoseconds.

Although researchers have known about this effect — called sonoluminescence — since the 1930s, they still do not have a complete understanding of how it works (SN: 10/23/93, p.271). The experiments of Hiller and his coworkers represent one attempt to elucidate the process.

The researchers found that raising the noble gas content of a nitrogen bubble in water to 1 percent dramatically stabilizes the bubble's motion. It also increases the intensity of light emission by a factor of at least 10.

At the same time, the spectrum of light generated by a bubble depends strongly on the gas inside the cavity. A bubble containing argon produces ultraviolet light that peaks at a wavelength of 300 nanometers. However, a helium-laced bubble shows no such peak.

"Some exciting atomic physics may be occurring within the collapsing cavitation bubble that gives rise to [single-bubble sonoluminescence]," Lawrence A. Crum and Ronald A. Roy of the University of Washington in Seattle comment in the same issue of SCIENCE. "However, many of the results [Hiller and his colleagues] present are also anomalous and defy immediate explanation."

Clearly, further investigations are necessary to pin down how sonoluminescence occurs. At the same time, the new results suggest the possibility of using gas impurities for improved control of the characteristics of light emissions from collapsing bubbles.

— I. Peterson

Shuttle radar views erupting volcano

Radar aboard the U.S. space shuttle Endeavour captured this false-color image of the Kliuchevskoi volcano in full eruption just 1 day after it roared to life Sept. 30 on Russia's isolated Kamchatka Peninsula.

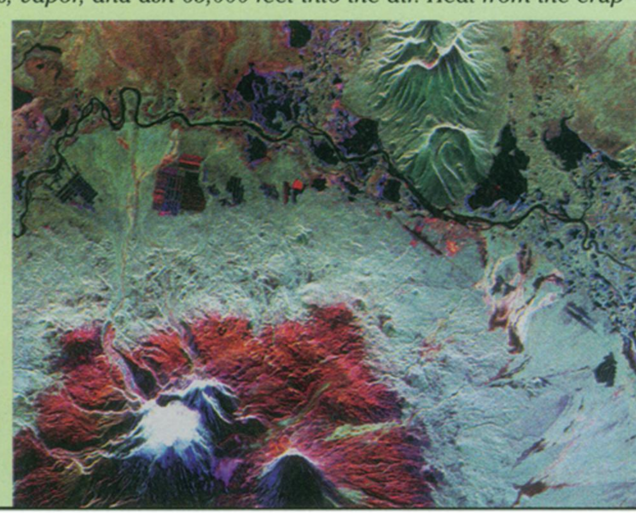
Kliuchevskoi, the white peak surrounded by red (lower left), overlooks the Kamchatka River, which runs like a black squiggle across the image. The green, wrinkly mound (upper right) is a dormant volcano. The area pictured covers about 18 miles by 37 miles. One of the most active volcanic zones in the world, the region sits on the boundary between two colliding continental plates.

The yellowish green lines on the flanks of Kliuchevskoi denote lava flows, and they look surprisingly distinct, says David C. Pieri of NASA's Jet Propulsion Laboratory in Pasadena, Calif. "There's something different about those flows . . . it bears looking into," he says.

Kliuchevskoi shot gas, vapor, and ash 65,000 feet into the air. Heat from the eruption melted snow that triggered mud slides, which may threaten homes to the north.

Geoscientists find radar imaging techniques particularly useful for studying erupting volcanoes because they can penetrate clouds and show a volcano's topography clearly, says Pieri. However, the images do not reveal the plume or the heat coming from the volcano.

— T. Adler



Calif. Institute of Technology/Jet Propulsion Lab.