SCIENCE NEWS of the week

Fusion Claims Multiply, Strengthen

A Brigham Young University physicist told a standing-room-only colloquium audience at Columbia University that he and his co-workers had devised a simple laboratory process for fusing small atomic nuclei into larger ones with an accompanying release of energy. His March 31 announcement — and sketchier fusion reports by scientists in Hungary and at Brookhaven National Laboratory in Upton, N.Y. — added fuel to the worldwide research wildfire ignited on March 23 by two chemists reporting a similar achievement (SN: 4/1/89, p.196).

"I'm not sure we're there yet, but I think we have a new way to fusion," said Steven E. Jones, speaking for his colleagues at Brigham Young University in Provo, Utah, and the University of Arizona at Tucson. Fusing pairs of atoms contained in just 1 ounce of deuterium — the double-heavy isotope of hydrogen abundantly available in ocean water — would release as much energy as about 70,000 gallons of gasoline, he calculated. In a press conference following the colloquium, Jones ventured it could be "20 years to never" before the new, bench-top brand of fusion became practical for generating power.

Other researchers' observations of fusion products such as tritium (an even heavier hydrogen isotope) in volcanic eruptions and helium in diamond led Jones and his associates to think that a so-called "piezonuclear fusion" (from the Greek word meaning to squeeze) process might be occurring within the Earth's crust and that perhaps they could duplicate this process in a lab.

Like B. Stanley Pons of the University of Utah in Salt Lake City and Martin Fleischmann of the University of Southampton in England, who had described their results just eight days earlier, Jones reported evidence of fusion reactions occurring in electrolysis cells created with a jar of heavy water, chemicals that make the water more conductive, and two metal electrodes. An electrochemical current between the electrodes split the heavy water into its deuterium and oxygen components. Jones' team used metals such as palladium and titanium for the negatively charged cathode. The group theorizes that as huge numbers of positively charged deuterium nuclei jam into the microvoids of the electrode's crystal lattice, a tiny but noticeable fraction of them fuse.

Jones and his colleagues spent years developing an extremely sensitive detector for measuring even tiny numbers of fusion-produced neutrons, an effort many observers say greatly strengthens their claim of fusion. "It looks like they made a very careful set of measurements," remarks physicist Gerald A. Navratil of Columbia University.

Less encouraging is the fact that their detector found so few neutrons spraying from the electrolysis cell and only for several-hour periods. The measurements correspond to mere whispers of fusion-generated power — about 10 trillion times less than what Pons and Fleischmann calculate they are getting in some of their experiments. Although this discrepancy demands caution in claiming that the coveted age of fusion nears, Jones and his colleagues remain optimistic. "While the fusion rates observed so far are small, the discovery of cold nuclear fusion in condensed matter opens the possibility at least of a new path to fusion energy," they write in a manuscript now under review by NATURE.

Despite failures to quickly replicate the fusion experiments, numerous physicists and chemists told SCIENCE NEWS that the successive announcements by the two independent groups bolster each group's individual conclusion that it has indeed discovered a new route to fusion.

Whether the research can lead to fusion-driven power plants remains an open question. Pons' and Fleischmann's observations of enigmatically large amounts of power — sometimes more than 4 watts of heat put out for 1 watt of electricity spent to run the cell — hint at a good prognosis. But their evidence for actually achieving fusion has weak points, some scientists say.

Particularly troubling is the indirect means they used for detecting neutrons of specific energies, an observation that physicists say would provide the strongest evidence for the occurrence of deuterium nuclei fusions. Also, the number of neutrons they claim to detect cannot explain the amount of heat they measure. In a paper accepted by the JOURNAL OF ELECTROANALYTICAL CHEMISTRY AND INTERFACIAL ELECTROCHEMISTRY, Pons and Fleischmann acknowledge "that the bulk of the energy release is due to an hitherto unknown nuclear process or processes. . . ."

Fraying some of the excitement, says Navratil, are ugly consequences that could emerge if the new electrochemical fusion technology matures. "The one that annoys me the most is the [potential] impact of this process on nuclear proliferation," he told SCIENCE NEWS. By using uranium as a target for the legions of hurling neutrons expected from larger-scale fusion of deuterium nuclei, people would find it relatively easy to start breeding plutonium, an essential ingredient in nuclear weapons, he says. No research group, however, has seen numerous neutrons in its experiments. Navratil and others agree it is too early to judge what, if anything, will develop from the newly discovered and poorly understood prospect for achieving fusion.

— *I. Amato*

Fantastic fortnight of active region 5395

Scientists at first thought the huge solar flare detected on March 6 was "merely" one of the largest in the last decade. In subsequent days, however, it turned out to have signaled the appearance of a spectacular active region on the solar disk, setting records at every turn.

Scientists have compiled detailed records of the last 22 solar cycles, each cycle

GSFC

Learmonth/Soon

On March 7, the day after it photographed a huge solar flare, Solar Max spotted this loop of ultraviolet emissions (left) expanding away from the flare's original location on the sun. The loop's curvature, says Stephen A. Drake of NASA Goddard, suggests it is one of the sun's magnetic field lines, outlined in hot plasma as a result of the flare. Twelve days later, with the same active region having moved across the sun, an Earth-based photo (right) shows the erupting plasma of another major flare.