Hot Water Source in Space May Act as Maser

Water molecules have been found in the interstellar medium and appear to be acting like masers, according to a research team at Berkeley (Albert C. Cheung, David Rank, Charles Townes, Douglas Thornton, William Welch) and the Naval Research Laboratory (Cornell Mayer and Stephen Knowles). By microwave observations with the 20-foot Hat Creek radio telescope and then the 85-foot NRL radio telescope, which gave more directivity, the group found water in eight different regions (*Nature* **221**, 626, 1969 and *Science* 163, 1055, 1969).

The most remarkable of the sources, W 49, shows an effective radiation temperature that is at least as high as 10^9 K. Consequently, Townes told PHYSICS TODAY, they are not observing equilibrium thermal radiation at all; rather, the water is acting like a maser. The intensity of some of the radiation from W 49 varies by a factor of two over the course of a week.

The possibility of maser action has also been suggested for the puzzling interstellar OH sources (PHYSICS TODAY, November 1967, page 69). The OH and H_2O sources show some sort of relationship, Townes says. "In some cases there is OH and not water, and in some cases water and no OH. But in most cases they're associated."

To establish the sizes of the water sources more exactly, measurements with long-baseline interferometers would be valuable. Such observations are being discussed by groups at Berkeley, NRL and the National Radio Astronomy Observatory at Green Bank.

H_2O is the second polyatomic molecule found in space. The first, NH_3, was also found by the Berkeley group (*Phys. Rev. Letters* **21**, 1701, 1968), late last year. —GBL

More Electron Rings: LRL Forms Them; Dubna Starts Extraction

A group from the Joint Institute for Nuclear Research, Dubna, is doing experiments to extract an electron ring from an electron-ring accelerator (smokatron), according to V. P. Sarantsev, who spoke at the March Particle Accelerator Conference in Washington. A 1.5-MeV electron beam is injected into the Dubna device and forms a doughnut, which is then compressed (PHYSICS TODAY, February 1968, page 51 and November 1968, page 61). Then hydrogen is injected, becomes ionized, and protons are trapped inside the ring.

By placing surfaces close to the ring the group expects to obtain extra focusing due to image effects. Then by varying the magnetic field with time they have tried to slide the ring out.

As experiments on ring extraction had begun only a few days earlier, Sarantsev explained that it is not yet clear whether the ring held together after extraction, and if so, whether protons had been accelerated. However, the experimenters did observe relativistic electrons leaving the compressor system and emerging from the bore of the accelerating solenoid.

At the same session Denis Keefe of Lawrence Radiation Laboratory, Berkeley, reported that his group has used 3.3-MeV electrons to form rings that were then compressed to a final radius of 3.5 cm and 19.0-MeV electron energy.

The group measured electron distribution inside the ring and found that the rms minor radius was about 2 mm. One powerful technique was to photograph the intense synchrotron light from the compressed ring. They were regularly able to compress rings containing 4×10^{12} electrons.

These observations correspond to a peak electric holding field of 12 MV/m, which Keefe said is certainly strong enough for a practical proton or heavy-ion accelerator. The experimenters varied the number of protons injected into the ring and found that they could achieve a high proportion of protons, much more than 1%. The rings were remarkably durable, too, lasting as long as 7 millisec. —GBL

V. P. SARANTSEV heads the Dubna group that has started experiments to extract an electron ring from their electron-ring accelerator. They have observed relativistic electrons emerging.

ELECTRON-RING CROSS SECTION was photographed (by the Berkeley group) with its own synchrotron light. Black dot and line are caused by camera grid. Height of photo represents 9 mm.

British and Dutch Build New Radio Telescopes

Two new radio telescopes are under way in Europe. At Westerbork in northeast Holland a 1.6-km interferometer array nears completion, and in England the Science Research Council has given the go-ahead for a 5-km interferometer at Cambridge.

The Dutch instrument, built by the Netherlands Foundation for Radio Astronomy and financed by the Netherlands Organization for the Advancement of Pure Research, consists of 12 parabolic reflectors, each 25 m in diameter. Ten of them are equally