unit of "polywater" is a very strong (60–100 kilocalories/mole) three-center O-H-O bond. The distance between oxygen atoms is estimated as 0.23 nanometers and the O-H distance as approximately 0.115 nm. Normal water has a hydrogen-bond energy of 4 kcal/mole and an oxygen–oxygen distance of 0.28 nm.

Two structures are proposed for polywater, both held together by delocalized three-center bonds (in which the electron wave function is spread over three atoms). One of the structures is a planar or puckered layer of hexagons. Each layer is negatively charged and is held to adjoining layers by protons or cations or hydronium ions (H_3O^+).

The second structure is a highly branched polymer chain; a high degree of branching accounts for the relatively few normal OH groups. The experimenters also considered a tetrahedral structure because quartz is tetrahedral. But according to Lippincott's group, if polywater were tetrahedral it would form from either normal water or one of the dense forms of ice; no one has ever observed this.

POLYWATER MAGNIFIED 80 times shows birefringence (white areas). Dark spots are voids in the material, which was dropped onto a surface from a capillary. (Lines are from the microscope eyepiece).

Although one crystallographer considers polywater work "the most exciting since noble-gas compounds were produced," others are reserving their judgment. A leading chemical physicist who has studied water for many years told PHYSICS TODAY he was not convinced that the group was studying pure water; he felt silicate impurities might have been absorbed in preparation. Although the spectra did not show such impurities, he noted that it is difficult to obtain spectra of amorphous substances. Two groups that have been trying to prepare anomalous water criticized the lack of details reported on the preparation. Both thought that because no capillary had been used to prepare more than one sample of water, this suggested that the capillary surface gave up something to the water. When we asked Lippincott about this objection, he replied that the procedure in question had been experimentally convenient and that he saw no reason why a given capillary could not be used repeatedly. —MSR

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CERN Storage Rings in Two Years: Experimenters are Making Plans

"Physics at 1500 GeV" was the title of a recent Princeton conference; it considered possibilities for American participation in experiments at the CERN Intersecting Storage Rings. When the ISR is finished (in mid-1971, according to schedule) 28-GeV protons will collide with 28-GeV protons; this reaction is equivalent to 1500–1700-GeV protons hitting a stationary target.

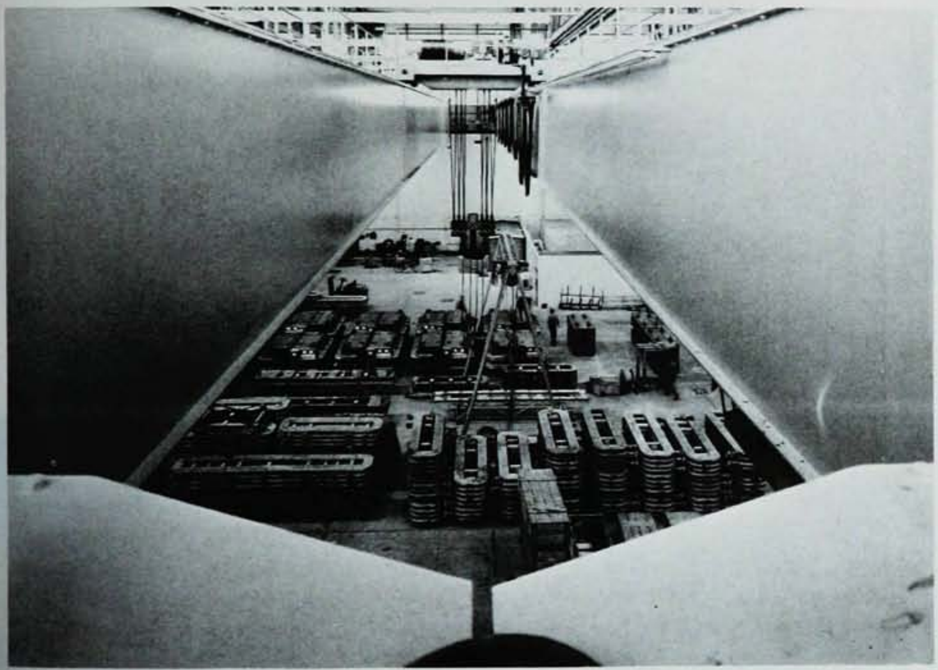
Victor Weisskopf, who was director-general at CERN when the ISR was proposed, said in his talk that he had trouble pushing the ISR at CERN because Brookhaven was opposed to it. "The fact that the US did not do it [build an ISR] is just what the doctor ordered for Western European physics . . .The mistake of Brookhaven was a tremendous advantage to Europe."

The ISR consists of two nearly concentric rings of magnets (300 meters in diameter), which intersect at 15-deg angles in eight places; two of the eight interaction regions will have experimental halls built around them. Protons are accelerated to 28 GeV in the proton synchrotron, ejected by a fast-ejection system into a transfer channel and guided toward the ISR,

DETAIL OF RING CONSTRUCTION. Experimental Hall II is in background; it has flexible shielding arrangements that can be readily adapted to different requirements. Inside width of the ring tunnel is 15 meters; inside height is 6.5 meters. Some of the 1 million tons of rock and soil removed during the year-long excavation of the ring will cover it with about 4 meters of shielding.

CERN PHOTOS

PREFABRICATION SHOP (color). Here are made the 50–60-ton blocks of reinforced concrete that make up the ISR tunnel. A partly completed section of the tunnel is in the background. The shop moves around the ring at 15 meters per week as construction progresses. Nearly three quarters of the ring tunnel has walls and roof assembled out of prefabricated concrete. The shop consists of forms for casting the concrete pieces, a steam curing plant and a gantry crane that spans the tunnel.



STORAGE-RING SITE (top left). The two experimental halls being built around the interaction regions (I1 and I4) are at upper and lower right respectively. Between the two are two ring octants already occupied. The 28-GeV proton synchrotron is in the upper righthand corner of the photo.

MAGNET ASSEMBLY SHOP (center) in west experimental hall. Coils are stored in foreground. Main magnets have C-shaped steel cores with excitation coils around the two poles. Units are assembled from cores and girders and aligned by four posts. At rear, coils are being mounted on magnet units.

MEASURING BENCH (bottom). Each magnet unit can be positioned to an accuracy of 0.1 mm. (All photos were taken in April and May).

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200 meters away. At a fork in the channel a bending magnet switches the protons to one ring or the other.

About 400 successive synchrotron pulses will be stacked in the ISR until full intensity is reached—4 $\times$ 10^{14} protons (equivalent to a circulating current in each ring of about 20 amperes). Filling is expected to take an hour; when synchrotron improvements are finished, filling may take only five minutes. Momentum spread across the beam is expected to be 2%.

Franco Bonaudi, who is in charge of ISR construction, said in his talk that the ring will be complete this month. Half the magnet blocks are on site; the remainder are expected by the middle of 1970. First injection tests are scheduled toward the end of that year.

Americans are involved in three experimental proposals being considered by CERN: Alan Krisch (University of Michigan) and Giorgio Giacomelli (University of Bologna) propose to look for all reactions in which one or more pions are produced. Rodney Cool (Brookhaven), Leon Lederman (Columbia), Luigi DiLella and Emilio Zavattini (CERN) want to search for large-mass particles decaying into electron-positron pairs. Gerard K. O'-Neill (Princeton) proposed a system for the study of forward-angle scattering processes.

German National Magnet Lab Will Have 5-MW Capacity

A West German National Magnet Laboratory is under construction at the Technical University of Braunschweig. The lab, which is scheduled for completion by the fall of 1970, will have four water-cooled Bitter magnets. The field strength available is expected to be at least 175 kilogauss and may be as high as 200 kG. Power for the magnets will be supplied by a 5-megawatt rectifying plant fed from the local ac network and delivering up to 500 volts dc. According to Edward Justi at Braunschweig this rectifying plant is believed to be the first of its kind, avoiding all rotating machinery. It uses silicon rectifiers, thyristors and several thousand transistors in a Darlington cascade to keep the current constant to 1 part in 10^5.

The Volkswagenwerk Foundation has given \$1.25 million towards the laboratory and will give an additional \$300 000 for five-years' running. Funds for the laboratory building came from the local government.

The Francis Bitter National Magnet Laboratory at the Massachusetts Institute of Technology has produced the world's largest continuous magnetic field, 226 kG in air, and has a 10-MW power supply. At Nijmegen in Holland a laboratory that is expected to produce a 150-kG field is almost complete. It may in the future produce 300 kG. Other high-field facilities include Oxford with 125 kG, the Royal Radar Establishment with 150 kG and the Lebedev Institute in Moscow with 9 MW and 175 kG. Funds have been obtained to increase the power of the laboratory at Grenoble, France from 2 MW to 10 MW.

Apollo 11 Success Brings Astronomy Down to Earth

With the success of the Apollo 11 moon walk, astronomy truly becomes a laboratory science. Observers can now hold an astronomical chunk in their own hands and can assault it with a wide range of standard terrestrial techniques. And from the moon itself a seismometer and reflector report on moonquakes and earth–moon distances.

Two devices make up the Early Apollo Scientific Experiments Payload (EASEP); the Laser Ranging Retro-Reflector (LRRR) and the Passive Seismic Experiment Package (PSEP). The retroreflector, which sends light directly back to its source, is an 1800-cm² array of 100 hollow prisms, each corner-cut from a cube of fused silica.

Carroll Alley of the University of Maryland heads the group that designed the reflector. By aiming Q-switched ruby-laser signals at the reflector and timing the beam's round trip, the group expects to measure the earth–moon distance to within 15 cm. Anyone with the proper ground equipment can use the retroreflector.

The LRRR permits a comparison of general relativity and Brans–Dicke theory, which says that the gravitational coupling constant changes with time. Measurements carried out over several years will test this contention and provide information on mascons, continental drift and the wobbling of the earth on its axis.

The solar-powered seismometer was designed by Gary Latham of the Lamont-Doherty Geological Observatory at Columbia. He, along with