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Bubble, bubble

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RESEARCH FACILITIES AND PROGRAMS

Do you annihilate positrons?

Physicists interested in positron annihilation in liquids or gases are invited to join in a mutual exchange of information on their research activities in these fields. The invitation comes from the department of physics at the University of Toronto where it is proposed to issue an information sheet for interested parties. Positron annihilators should communicate with Dr. Derek Paul, Physics Department, University of Toronto, Toronto 5, Ont., Canada, or with Dr. G. J. Celitans, Physics Department, The Hiram Scott College, Scottsbluff, Neb.

Bubble, bubble

A new liquid-hydrogen bubble chamber is being constructed at Argonne National Laboratory. The chamber will be about 4 meters in diameter and a meter and a half high (Argonne gives the dimensions in deplorable English units) and will be one of the first of the coming size range in bubble chambers. Brookhaven has plans for a slightly larger chamber, but they have not yet been approved by funding agencies. A heavy-liquid chamber 4.5 by 1 by 1.5 m will be built at CERN, and a 2-m hydrogen chamber is under construction at Dubna.

For the Argonne chamber, a new experimental area north of the Zero-Gradient-Synchrotron ring will be built. The area will contain a hall to house equipment for beam transport and a building about 30 by 40 m to house the chamber itself. The beam hall will have facilities for tapping the beam to conduct experiments other than the one going on in the bubble chamber. The project will cost $17 million, of which $12 million is for the chamber itself.

The chamber will not have windows; they would be prohibitively expensive for its size. Instead, four built-in cameras will photograph particle tracks. The sides and bottom of the chamber will be lined with Scotchlite (the reflecting material used on highway signs) and will provide a luminous background by reflecting light from flash rings surrounding the camera lenses. Tracks will appear as dark shadows against the background. By properly timing the chamber operation, Argonne people hope to get as many as three complete sets of track pictures per pulse.

To give good curvature to charged-particle tracks, a magnet of about 20-kg field strength is being designed.

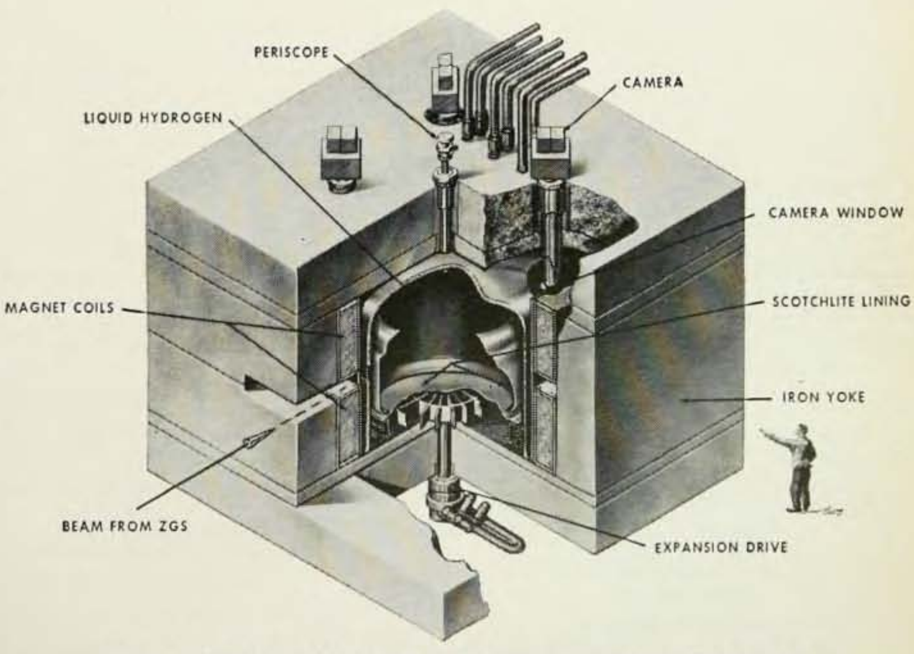
The weakest interaction

What causes supernova explosions? What powers quasistellar radio sources? How might the universe, in the far distant future, begin to contract? The answer to all of these questions may be gravitational collapse. At the January meeting of the American Physical Society, John Wheeler discussed this topic under the title "Gravitational Collapse—to What?"

The idea that a sufficiently large and sufficiently compact amount of matter may not be able to sustain itself against the mutual gravitational attraction of its parts goes back to a study of the structure of matter and of standard Einsteinian gravitational theory by Lev Davydovich Landau in 1932. By the end of the 1930's, work by J. Robert Oppenheimer, Robert Serber and George M. Volkoff had shown that the critical mass was about 7/10 that of the sun. If one asks why the sun does not collapse, the answer is that it is too hot and dilute (average density equal to that of water, central density eighty times water). To collapse, the mass has to be compact and cold with a density comparable to that of an atomic nucleus. A star so compact would have a diameter of 30 km or less (a so-called "neutron star") instead of the 1.6 million-km diameter of the sun.

Because of the inverse-square law of gravity, a millionfold decrease in the distance between one part of a star and another produces a million-millionfold increase in the gravitational forces. The material of a cold star of more than critical mass, no matter how compact, cannot produce elastic forces capable of withstanding the attraction. The material will fall inward with ever increasing speed until it reaches a final state whose details are difficult to figure out.

The class of objects called "cold stars" (bodies that have exhausted all



NEW BUBBLE CHAMBER at Argonne National Laboratory