physical sciences

Gathered at the 1971 Particle Accelerator Conference in Chicago last week

ELECTRON-RING ACCELERATORS

California project slowed

Electrons are easier to accelerate than protons. One possible way to achieve cheap acceleration of protons (or positive ions) is to have them hitch rides with bunches or rings of electrons. A device to do this is called an electron-ring accelerator and for some years physicists, particularly in the Soviet Union and at the University of California at Berkeley, have been experimenting to find out if one could be built (SN: 7/12/69, p. 35).

Up to 1968 the Berkeley project had demonstrated that the rings of electrons could be made, compressed to a few millimeters diameter and loaded with protons. The next part of the project was a device called compressor 3, which was to prove that rings of electrons could be extracted from the compressor into an accelerating tube.

Unfortunately it never got the chance, Dr. Edward J. Lofgren told the meeting. The group had been using the electron injector belonging to the Astron plasma physics experiment, and their allotted time with it ran out before they could complete their experiments. They are now at work on compressor 4, which will study certain difficulties of ring formation without extraction.

ELECTRON-RING ACCELERATORS

Heavy ions at Maryland

An electron-ring accelerator to accelerate heavy ions for studies of nuclear structure and nuclear chemistry is under construction at the University of Maryland, reports Dr. Martin P. Reiser.

Instead of using pulsed magnetic fields to compress the electron rings, as the Berkeley project does, the Maryland experiment will attempt to use static magnetic fields. If it succeeds, it will simplify the technology of such devices.

The project is being conducted in cooperation with the National Bureau of Standards. At present the electron injector for the machine is being built. Dr. Reiser says they hope to have everything assembled by sometime in the spring of 1972.

RADIOLOGY

Mu mesons for diagnosis

The mu meson is one of the most unwanted particles in physics. Its properties duplicate those of the electron except that it is 200 times as heavy. The mu meson is unstable; it plays no apparent part in the structure of matter, and it has no place in the schemes and patterns by which physicists try to make sense of the multitude of particles.

Physicists are hard put to find a reason why mu mesons should exist. Nevertheless Dr. Louis Rosen of the Los Alamos Scientific Laboratory in Los Alamos, N.M., has found a practical use for them. If a biological specimen is irradiated with mu mesons, he says, study of the pattern of absorption of the mesons will tell what chemical elements are in the specimen. This kind of analysis can be done in a living specimen, and Dr. Rosen suggests it will be useful in making medical diagnoses.

RADIOLOGY

Neutrons and pi mesons vs. tumors

When X-rays are used to kill tumors, they tend to do as much damage to tissues they go through on the way to the tumor as they do to the tumor. Using X-rays on deep-seated tumors is therefore a dangerous procedure.

What is needed, says Dr. Max Boone of the University of Wisconsin, is a form of radiation that does little damage on the way in, but maximum damage to the tumor. Such radiation is available in the form of fast neutrons and pi mesons.

X-rays damage cells by ionizing atoms, and they do it along their whole path. Neutrons and pi mesons damage by causing nuclei to fission, and they do it only at the ends of their paths. How far the neutrons or pi mesons penetrate before causing fissions depends on their energy, so by varying the beam energy the therapist can insure that they will be effective at the level where the tumor lies.

Dr. Boone showed pictures to illustrate how neutron irradiation had done away with cancers of the mouth and breast.

SUPERCONDUCTORS

Disagreement over magnets

The size of a circular particle accelerator such as a synchrotron is determined by the strength of its bending magnets. The bending magnets force the beam of accelerating particles to move in a circular path; the stronger the field, the narrower the circle.

To keep the size of synchrotrons within bounds as energy goes up, stronger magnets are needed. A persistent belief is that superconducting magnets could provide stronger fields without the tremendous cost in power that conventional magnets would require.

A panel under the chairmanship of Dr. John P. Blewett of Brookhaven National Laboratory discussed the prospect and showed that there is some uncertainty about whether the power saved in a superconducting magnet will be enough to offset the power used in refrigerating it. There is also a good deal of uncertainty whether superconducting magnets can effect economies in the capital cost of accelerators, the factor that makes governments reluctant to build them.

The problem is that superconducting magnet materials are now very expensive and no one is sure whether developing technology will make them cheaper. Estimates of the cost of superconducting accelerators run from a tenth to a fourth to a half of conventional accelerator costs to no saving at all.