

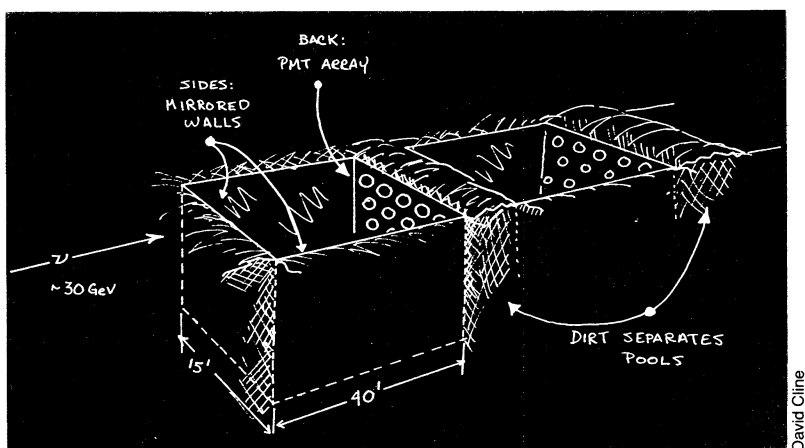
neutrinos having mass. Decay is forbidden to zero-mass particles.) But Erwin found it necessary to begin with an assumption that the 12 previously mentioned basic building blocks are not basic but composite, being made of something he calls "subquarks." Thus, there could be a new level of complexity to be investigated in the structure of matter.

Experimenters are galloping off after neutrino oscillations, planning, proposing, setting up experiments. Brookhaven National Laboratory, Fermilab and the Los Alamos Scientific Laboratory seem likely to be sites of major efforts. There is much discussion over what to use as a source of neutrinos: reactors, the usual beams of neutrinos provided by accelerators or beam dumps. Density of beam varies. Different designs of detector are favored by different groups and different distances from the neutrino source. Some detectors will be put on rails to provide varying distances.

Los Alamos, in the person of Minh Duong-Van, points out that it has a unique advantage in its main accelerator, the Los Alamos Meson Physics Facility. This machine produces copious beams of K and pi mesons (it was designed for research with them). When these mesons decay, they produce dense and dynamically well-defined beams of neutrinos. One experiment described by Duong-Van would have detectors moving up and down a tunnel 25 meters underground using the native Los Alamos tuff as cost-free shielding against background radiation.

K and pi mesons, as well as mu mesons, which also yield neutrinos when they decay, can be introduced into storage rings. The mesons would circulate in the rings, producing beams of neutrinos that fly off tangentially. These again would be "tagged" neutrinos; the dynamics of their point of origin would be known better than those for reactor neutrinos. David Neuffer of Fermilab suggests that a proposed facility, the Fermilab cooling ring for antiprotons, which is intended to assemble pulses of antiprotons and equalize their energies and momenta, could be used as a muon storage ring. Such a use could be parasitic on the antiproton cooling function or instead of it. Alternately, a special muon storage ring could be built if the money can be found. (The first alternative would save.)

In case it is necessary to go very long distances, David Cline of the University of Wisconsin and others did a survey of the territory around Fermilab to see how far they could get. Starting off in line with the regular Fermilab neutrino beam led them northeast to the Chicago suburb of Schaumburg, where the combination of topography and earth curvature sends the neutrino beam into the atmosphere. Schaumburg is expensive real estate. Cline admits, and he and his co-surveyors haven't gotten around to discussing with the people there what they might like to



Long-distance neutrino detection might be done in a series of water pools.

put down for a detector (probably a tank of water about the size of a swimming pool). Meanwhile, they took off on a line tangent to the proposed antiproton cooler, in a direction toward Elgin, north of the facility. Near Elgin they found a mental hospital

that is being phased out. This could be ideal for a detector site as it is already state property. However, Cline warned the assembled physicists not to let the nature of the institution color their judgment of the experiment. □

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GLOSSARY OF GEOLOGY, 2nd ed. — Robert L. Bates and Julia A. Jackson, Eds. Prepared under the auspices of and published by the American Geological Institute, this 2nd edition of the Glossary contains approximately 36,000 terms, over 3,000 of them new, in all disciplines of earth and planetary sciences. Includes a bibliography of more than 2,000 references. Am Geol, 1980, 749 p., \$60.

AN INTRODUCTION TO DATA ANALYSIS — Bruce D. Bowen and Herbert F. Weisberg. Intended to explain the general principles of data analysis so that the reader will be able to read reports based on the analysis of data and know how to analyze data. W H Freeman, 1980, 213 p., charts & graphs, \$15.95, paper, \$7.95.

LIGHT AND ITS USES: Making and Using Lasers, Holograms, Interferometers, and Instruments of Dispersion — Introductions by Jearl Walker. These articles from The Amateur Scientist department of *Scientific American* are, according to the preface, the perfect introduction to science for tinkerers. Step-by-step instructions are given for these projects in optics. W H Freeman, 1980, 147 p., illus., \$17.50, paper, \$8.95.

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MATHEMATICS AND HUMOR — John Allen Paulos. A parallel consideration of the illogical structure of humor and the logical structure of mathematics. U of Chicago Pr, 1980, 116 p., illus., \$12.95.

THE NEW LAROUSSE ENCYCLOPEDIA OF ANIMAL LIFE — Maurice Burton, Ed. The revised edition of this classic work on animals brings the text in line with recent discoveries in zoology. Every major animal group is covered. 800 color photographs enhance the text. Larousse, 1980, 640 p., color illus., \$50.

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A WORLD LIST OF MAMMALIAN SPECIES — G. B. Corbet and J. E. Hill. An attempt to present a comprehensive list of all living mammal species, including recently extinct species. The listings include genus name, English vernacular names (if they are well established) and geographical range. Endangered species are indicated. British Museum (Natural History)/Cornell U Pr, 1980, 226 p., \$35.