Salvaging Some Equipment

New Uses for Low-Energy Accelerators. Prepared by the ad hoc panel of the Committee on Nuclear Science of the National Research Council. National Academy of Sciences, Washington, D.C., 1968 (available for limited distribution from the Physics Section, National Science Foundation, Washington, D.C.). x + 174 pp., illus. Paper.

Low-energy accelerators of protons and heavier ions have served science well. In the four decades of their use, light-element nuclear physics, for which they were intended, has had thorough and imaginative investigation. In the process generations of scientists have been trained and instrumentation has been developed that has aided many fields.

Consequently, in the United States alone, over 112 low-energy accelerators of 6-Mev energy or less are now in operation. An indefinitely long continuation of this same service can hardly be expected for all of these accelerators. The higher-energy tandem Van de Graaff accelerators in operation during the last decade allow the same precision measurements, but for all elements and to higher states of nuclear excitation. In the present competition for accelerator operating funds, low-energy accelerators therefore face an uncertain future.

Certainly these valued instruments deserve a more respectable future than to serve primarily as demonstrations of capital-equipment posession. Fortunately, rescue has come through a deliberate effort by a blue-ribbon group of American scientists led by William A. Fowler of the California Institute of Technology.

The resulting report, *New Uses for Low-Energy Accelerators*, is a splendid solution. The book reviews several fields of investigation, most of them excitingly new, in which the accelerators might be used. These are not merely experiments desirable to do. Instead they are whole fields for exploration, analogous to the nuclear physics for which these accelerators were built.

What are these means to the salvation of low-energy accelerators? One is nuclear astrophysics, in which the previous nuclear physics efforts are redirected to measurement of those particular reactions involved in stellar processes. The others are in a category now called atomic-collision physics. One is the venerable atomic spectroscopy, but with an accelerator-based technique promising to revolutionize the field. The other is the study of solids, particularly crystalline solids, by the use of accelerated particles to alter the solids or to provide probes of unprecedented sensitivity. Contained in these fields are surely many of the basic science discoveries of the future, many industrial applications, and the training of a new generation of scientists able to serve in these blossoming areas.

Not only does the report justify the importance of these new fields for low-energy accelerator research, it provides easy-to-follow instructions on how to become quickly productive on the frontiers (at the 1967–68 writing) of these fields. In each field, an unusual—and pleasing—combination of information is provided. First is a scholarly summary of the field including impressive bibliographies. Next is an apparently complete disclosure of precious information, items the experts believe should be investigated. (The authors are so considerate that they even caution when a certain area is too complex for neophytes.) Finally, a time- and effort-saving list of sources for unusual needed equipment is given.

Enthusiastic scientific endorsement of these new fields is readily found, even aside from the apparent need for a redirection of much of the low-energy accelerator effort away from traditional nuclear physics. Astrophysics appears destined for an unusually large expansion of effort; surely experimental nuclear astrophysics at accelerators will similarly increase even though much has already been measured. In only the first few years of optical spectroscopy at accelerators, discoveries have already been made that rival the near-century of traditional non-accelerator spectroscopy—and with confusion about impurities now eliminated. The quietly increasing attention of industry to the use of accelerated particles in materials science is evidence of the importance of low-energy accelerators to solid-state physics.

On almost all counts, this report is more valuable than the several recently published proceedings of conferences on related subjects. Obviously, a panel can provide more of value than a mere collection of individual contributions. (Not citing individual authorships seems to be overdoing the public-service aspect of this report, however.) To cite still another merit, note that this report is provided in limited number to the needy as a courtesy of the National Science Foundation.

This report deserves to be a manual for a new era for low-energy accelerators, whose devotees might otherwise fall behind the general scientific advance.

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Petrology

Recent Developments in Carbonate Sedimentology in Central Europe. A seminar, Heidelberg, July 1967. G. MÜLLER and G. M. FRIEDMAN, Eds. Springer-Verlag, New York, 1968. viii + 256 pp., illus. $14.50.

A total of 30 papers, all in English, are grouped into five sections, although the last section, Applied Carbonate Petrology, consists of a single brief paper on gasometric determinations used for comparative analysis of drill cuttings. A sample of the diverse types of deposits under investigation can be seen in reports of the studies of Schöttle and Müller on the Recent freshwater carbonates of Lake Constance, Matter on the Ordovician tidal flat deposits of western Maryland (U.S.A.), Füchtbauer on the Zechstein Basin, and W. E. Krumbein on the Nari-Lime Crust of Israel, all under the heading Regional Carbonate Petrology.

The section on geochemistry includes among others an article on calcium-magnesium distribution in the Lower Keuper, northwest Germany (Marschner) and one on the strontium content of recent and fossil limestones (Bausch), which tend to be discussions reevaluating previous data and theories in the light of local considerations. One of the few reviews is a paper by Flügel *et al.* on electron microscope studies of limestones in the section Microtexture and Microporosity of Carbonate Rocks. The authors imply that diagenetic processes may be recognized by such studies. An annotated bibliography of recent contributions utilizing the electron microscope is included at the end of the paper.

The section Processes of Carbonate Formation and Diagenesis includes an interesting discussion of the formation of ooids and other aragonite fabrics in warm seas by Bathurst. Lippmann again discusses the low-temperature synthesis of norsethite, $BaMg(CO_3)_2$, with dolomite-type structure. However,