PREFACE

High-energy physics today is a productive and exciting field. Over the past three decades, its practitioners have put together what they call the Standard Model—a picture of matter that encompasses almost everything known about the particles and forces in nature. They are now planning the Superconducting Super Collider, or SSC, a huge device designed to explore the behavior of matter at energies well beyond the capabilities of existing machines and to help supply missing pieces of the Standard Model. Housed in an oval tunnel 53 miles around, the SSC will be the largest single piece of scientific equipment ever built. Scheduled for completion in the late 1990's, it will be an effort as significant as the Manhattan Project to build the atomic bomb during World War II or the Apollo space program of the 1960's.

The Standard Model and the SSC, however, are only the capstones of an enormously productive period in high-energy physics. Since the 1950's U.S. scientists have learned much about the basic building blocks of matter and the principles by which they behave. But to uncover this knowledge, they had to build and operate particle accelerators—the workhorses of high-energy physics and forerunners of the SSC. Physicists' ability to understand ever deeper regions of matter has gone hand-in-hand with the construction of ever-larger and more powerful accelerators.

The first particle accelerators were usually built with private investment, but after World War II scientists had to find bigger sources of funds. While a few early accelerators were funded by the U.S. Office of Naval Research, more and more frequently the Atomic Energy Commission (or AEC) provided the investment. Established in 1946, the AEC was succeeded in 1974 by the Energy Research and Development Administration (or ERDA). These government agencies funded the construction of the accelerators—as well as the equipment, salaries, and expenses of the physicists who worked on them.

Today the U.S. Department of Energy (or DOE), which succeeded ERDA in 1977, is the principal supporter of U.S. high-energy physics. It funds not only the construction of the accelerators, but also the operating costs of the national laboratories at which they are located as well as many of the university scientists who, as users of these facilities, perform most of the research. At present there are three such laboratories—Brookhaven National Laboratory on Long Island, New York; the Stanford Linear Accelerator Center in Menlo Park, California; and the Fermi National Accelerator Laboratory in Batavia, Illinois.

The research funded by the DOE and its precursors at these and other facilities has not only brought high-energy physics to the verge of a unified picture of matter, it has also produced numerous technological spinoffs, including advanced computers, superconducting magnets, medical equipment, and much more. Because of this work, the U.S. has assumed world leadership in high-energy physics research, and its physicists have won over two dozen Nobel prizes since the end of World War II. This document summarizes some of these achievements.