

Another laboratory has played a leading part in developing computerized methods for the automation of infrared spectroscopy. A file of some 30 computer programs put into modular form and distributed as a series of bulletins, card decks and tapes has attracted wide interest from industrial and university laboratories. This laboratory has also been intimately involved, in association with the CODATA Task Group for Computer Use, with the more general problems of computer-based techniques for the evaluation, storage and retrieval of numerical scientific data of various kinds. This work will have important applications in the pharmaceutical and petroleum industries.

**The Division of Physics** has three general areas of work: the improvement of Canada's social and economic climate by providing new data, concepts and designs to industry and government; the maintenance of physical standards of the highest quality; and the study of particular areas of physics in which the Division has a special competence. These activities are intermixed in sections devoted to acoustics, cosmic rays and high energy physics, electricity, heat, mechanics, metal physics optics, photogrammetry, plasma physics, spectroscopy, time, X-ray and nuclear radiation.

The Division maintains standards in the fields of mass, length, time, electricity, temperature radiation, photometry, colorimetry and acoustics. Besides providing these standards to Canadian industry and governments, the Division has a continuing program of comparisons of Canadian standards with those maintained by other industrial nations, thereby ensuring the acceptability of Canadian measurements in international trade. A third aspect of the standards work in the Division is a program to improve the primary standards so that future measurements will be more convenient and more precise.

During the past year the Division has been involved in a number of programs of significance to Canadian industry. A program of testing and calibrating high-quality industrial measuring devices has been continued and two seminars to acquaint industrial engineers with recent developments in measuring techniques have been held. An automatic colorimeter has been built and it appears that this instrument will be developed commercially. The instrument devised in previous years to measure automatically the depth, salinity and temperature of the ocean has been improved to give it a much faster response. A carbon dioxide laser designed for use in plasma studies has proved suitable for commercial production. A computer program designed to calculate the shielding of composite materials for various high energy radiations has been developed to aid in producing commercial shielding material. These and other commercial developments have their origin in the study and development of standards and in the studies of basic physics.

The long-range studies of a few selected areas of physics have been continued. During the past year significant new information on the nature of the charged particles captured by the earth's magnetic field has been obtained from experiments carried out with the ISIS-1 and ISIS-2 satellites. A number of the energy levels of light nuclei have been investigated with the linear electron accelerator and the positive ion accelerator. In the spectroscopy laboratory two-photon spectroscopy has been used for the first time to obtain accurate data on the vibrationally excited states of some simple molecules. The capabilities of the electrical standards laboratory have been extended by the construction of a very accurate low-frequency voltage divider. A new cesium time standard has been constructed which shows promise of considerably improving the accuracy of time measurements. The wavelengths and the frequencies of the emission lines from stabilized lasers have been measured and have yielded a more precise value for the velocity of light. Results on these and other similar programs are published in the scientific journals.

**The Division of Mechanical Engineering.** During 1971-72, a breakdown of the activities of this Division indicated the following: manufacturing technology 40%, transportation technology 40%, standards and standardization in the engineering industries 7%, computer applications 6%, engineering and biological control systems 4%, and medical and surgical instrumentation 3%.

Transportation work is about equally divided among land, sea and air developments. Land transportation activity is related mainly to the welding of rails for the Canadian railways, to apparatus for preventing the malfunctioning of railway switches in winter, to gas turbines and compressors for gas pipelines and to the examination of various aspects of container shipping, whether by rail or road. A substantial body of research is directed to special-purpose