Gennadiĭ Ivanovich Dimov (on his sixtieth birthday)

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Gennadiĭ Ivanovich Dimov, well known experimental physicist, corresponding member of the Academy of Sciences of the USSR, and head of a laboratory of the Nuclear Physics Institute, Siberian Division, Academy of Sciences of the USSR, is sixty years old.

Dimov was born on December 27, 1927, in the village of Kudara in the Baikal-Kudarinsk region of the Buryat Autonomous SSR. The war forced him, like many others at that time, to interrupt his education and go to work. Like few of the others under those complex conditions he was able to return to his education, to complete school, and enter the Physico-technical Department of the Tomsk Polytechnic Institute, and on completion of this course in 1951 he was accepted as a graduate student at the Tomsk Polytechnic Institute. His scientific activity began with the development of iron-free circular accelerators. Already in 1952 he completed one of the first iron-free betatrons. In 1954 Dimov defended his candidate's dissertation. In the period 1954–1960 the laboratory headed by him at the Tomsk Polytechnic Institute developed and built one of the largest electron synchrotrons at that time, with energy 1.5 GeV. This machine is operating at the present time.

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In 1960 Dimov transferred to the newly organized Institute of Nuclear Physics of the Siberian Division, Academy of Sciences of the USSR. Here his extensive experience in experimental physics assisted in the rapid completion of the first colliding-beam installations. From work on planning the first proton-proton and proton-antiproton storage rings begun at the initiative of G. I. Budker, charge-exchange injection of protons into accelerators and storage rings was developed, a technique which has received extensive international acceptance. Charge-exchange injection permitted avoidance of the limitations on the intensity of stored beams due to Liouville's theorem and permitted filling to the space-charge limit contemporary accelerators with large phase space with limited intensity of the injected beams, which is particularly important for production of intense beams of polarized particles. In these studies the fundamental bases of charge-exchange injection were developed and the necessary technical devices were created (sources of intense beams of negative ions with high brightness, charge-exchange targets in the form of well shaped ultrasonic gas jets in vacuum, small fast-acting gates for admission of gas into the vacuum, means of observation of beams, and ionization profilometers, which are now used to obtain the most detailed information on the characteristics of proton beams in accelerators and storage rings, and other devices). Study of the mechanisms of limitation of the intensity of stored beams permitted subsequently the accomplishment of compensation of the proton space charge by electrons, exceeding by an order of magnitude the limit on the intensity of circulating beams due to space charge, and going over to a fundamentally new mode of operation of cyclic accelerators with confinement of particles in collective self-consistent fields. In the course of these studies a number of new instabilities of intense compensated beams were observed experimentally and investigated, and methods of their stabilization were found.

After 1971 Dimov and his colleagues developed a surfaceplasma method of obtaining beams of negative ions with capture of electrons from solids into electron-affinity levels of particles sputtered and reflected in bombardment of the surface by the ions of a gas-discharge plasma. Detailed investigations permitted in a short time the understanding of the physical bases of the mechanism of production of negative ions and development of surface-plasma sources of H^- ions comparable in their characteristics with the best proton sources. The creation of these sources permitted realization in complete measure of the advantages of charge-exchange injection, and with this added feature it was rapidly confirmed in almost all of the major proton synchrotrons in the world.

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Broad international acceptance has been given to Dimov's work on the production of intense beams of accelerated atoms for plasma heating. Already during development of charge-exchange sources of negative ions he successfully used for the first time multigap systems of precision shaping of positive ion beams, which permit increase of the perveance of ion sources by an order of magnitude. Dimov and his colleagues noted for the first time the fundamental importance of stability of the emitting plasma for production of good ion-optical characteristics and stable compensation of the space charge of beams. These results became the basis for contemporary injectors of accelerated hydrogen atoms for plasma heating and other applications. Quasistationary injectors of atoms with beam power in the megawatt range have been developed.

To obtain atoms with energies above 100 keV surface-plasma sources of H^- ions with current of more than 10 A were developed. Plasma targets were suggested for increase of the efficiency of conversion of high-energy H^- ions into atoms. The high efficiency of targets of lithium, magnesium, and hydrogen plasma was confirmed experimentally.

These results served as the basis for setting up corresponding studies in a number of laboratories of the Soviet Union and many laboratories in the USA, England, Japan, West Germany, and other countries, and became the subject of specialized international symposia. In the development of these problems Dimov's laboratory has held a leading position in the world for a number of years.

A particularly great response was given to Dimov's suggestion in 1976 to use the ambipolar electric fields which arise in confinement of the plasma in a classical probkotron for improvement of the longitudinal confinement of plasma in straight magnetic traps. On this basis in a short time the fundamental bases were developed for obtaining and confining plasma in ambipolar traps, which permitted experimental investigations to be carried out. These ideas became the basis of a new direction in controlled thermonuclear fusion which has been actively supported in the USA and Japan as a source of new physical results in plasma physics. Experiments in the large-scale thermonuclear installations in the USA and Japan (TMX, TMX-U, GAMMA-10) have confirmed that ambipolar barriers are a splendid means of blocking the departure of particles along the magnetic field, thus increasing the longitudinal lifetime to hundreds of milliseconds.

It would have been impossible to obtain these results without the great concern of Dimov for the training of scientific personnel and his major work in scientific organization. For many years he taught at the Physico-technical faculty of the Tomsk Polytechnic Institute, and after moving to Novosibirsk—in the chair of general physics of Novosibirsk State University; in 1972 he became a professor, and for a number of years he headed the chair. His laboratory staff are greatly concerned with students, and many of his pupils and colleagues have defended their candidate's and doctor's dissertations and have become acknowledged specialists. The work of Dimov and of the laboratory headed by him in the area of the physics and technology of accelerators, the production and use of accelerated particle beams, and the physics of plasma and controlled thermonuclear fusion has received wide international acceptance, is known all over the world among specialists, and has been distinguished by government awards. A large fraction of Dimov's daily concerns involve the general problems of the Nuclear Physics Institute of the Siberian Division and work with scientific councils and editorial boards.

A great and diverse experience in experimental physics, a deep understanding of the physical essence of problems, an independent nature of approaches to problems, a striking capability for work, and persistence are characteristic features of Dimov's scientific activities.

The friends and colleagues of Gennadiĭ Ivanovich Dimov congratulate him on his anniversary and wish him excellent health and new success in his continuing search for solutions of complicated scientific problems.

Translated by Clark S. Robinson