Boris Borisovich Kadomtsev (on his sixtieth birthday)

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Academician B. B. Kadomtsev, a noted scientist in the fields of plasma physics and controlled thermonuclear fusion, celebrated his sixtieth birthday on November 9, 1988.

B. B. Kadomtsev was born in the town of Panfilov in the Taldy-Kurgan region. He grew up in Penza, where he completed high school. In 1946 he enrolled at the physics department of the M. V. Lomonosov Moscow State University. After graduating from MSU in 1951 B. B. Kadomtsev began his research career under D. I. Blokhintsev at the Physicotechnical Institute in Obninsk, specializing in theoretical problems of nuclear energetics. Among his successes in this field were his proof of reciprocity for the point source function in the kinetic equation, as well as his generalization of the Ambartsumyan invariance principle for the calculation of the albedo of a medium for neutron and light irradiation to the case of a homogeneous object of arbitrary shape. After attending the 1955 All-Union Seminar on the problems of controlled thermonuclear fusion (CTF) organized by I. V. Kurchatov, Boris Borisovich was caught up in the urge to study high-temperature plasma physics. When D. I. Blokhintsev transferred to the Joint Institute for Nuclear Research at Dubna in 1956, B. B. Kadomtsev switched to the Kurchatov Institute, where he joined the theory research group of M. A. Leontovich.

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At the I. V. Kurchatov Institute of Atomic Energy (IAE) B. B. Kadomtsev's talent, outstanding intuition, and ability to grasp the essence of complicated phenomena came to the fore. In his very first years of investigating thermonuclear fusion B. B. Kadomtsev completed pioneering studies in stability theory, kinetic phenomena and turbulent processes in magnetically confined plasma. He predicted one of the most dangerous instabilities in magnetically confined plasma—the convective instability, formulated a clear picture of its evolution in experiments on plasma confinement in open traps, and developed methods of suppressing it. His theory of convective current instability of the plasma in a glow discharge placed in an external magnetic field accurately described the experiments of Lehnert and Hu, predicted the magnitude of the critical field and estimated the anomalous diffusion rate (in 1960, together with A. V. Nedospasov). These results also proved useful in the theory of electron-hole plasma in semiconductors. These advances broke new ground in CTF because they destroyed the pervasive notion of universal "Bohm" diffusion that seemingly prevented any technical realization of magnetic confinement of thermonuclear plasma. Thereafter scientists could feel confidence that plasma processes were controllable.

Among B. B. Kadomtsev's works of that period we should mention his research into the self-maintenance of toroidal magnetic fluxes in toroidal pinches stabilized by weak magnetic fields. In effect these were the first steps towards the explanation of "self-organization" of strongly inhomogeneous plasma continuously supplied with energy.

In 1960–1961 B. B. Kadomtsev completed a major research project on the theory of collective processes in high-temperature plasma. The results were summarized in his monograph "Plasma Turbulence," published in the series "Problems in Plasma Theory" and also as a separate volume in English by Academic Press in England. At the time he also deduced (together with V. I. Petviashvili) the well-known two-dimensional nonlinear integrable equation for ionic-acoustic waves (the Kadomtsev-Petviashvili equation). This series of papers made him an acknowledged authority in a newly burgeoning field of collective phenomena in plasma.

In 1962 B. B. Kadomtsev was elected a Corresponding Member of the USSR Academy of Sciences. From 1965 onward he concentrated his efforts on plasma physics in toroidal tokamak systems. Together with O. P. Pogutse he developed the widely-known general method of classifying instabilities and estimating turbulent processes in toroidal plasma. Yet B. B. Kadomtsev never lost interest in the gen-

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eral questions of theoretical physics. Thus, after the discovery of pulsars he carried out a number of interesting investigations into the properties of materials in ultra-strong magnetic fields.

Concurrently he completed an analysis of the consequences of various instabilities in high-temperature plasma and concluded that a tokamak thermonuclear reactor was technically feasible. These advances proved of great importance to CTF. Subsequently, in step with the world-wide development of experimental studies of the heating and containment of plasma in tokamaks, B. B. Kadomtsev devoted much of his attention to the analysis of different tendencies in such systems: plasma current quenching and relaxation oscillations, anomalous transport processes and scaling behavior, and plasma self-organization (i.e., the appearance of stable current distributions in tokamak plasmas).

At a time when investigations into plasma processes in toroidal magnetic systems attracted large collectives of theorists from a number of major laboratories worldwide, B. B. Kadomtsev displayed an uncanny skill for discerning "hot topics" in plasma physics. He would develop approaches to solving problems that would be followed by tens and hundreds of other researchers. The thermonuclear physics community is thoroughly aware of the stimulating role played by B. B. Kadomtsev's ideas and profound heuristic predictions of the evolution of complex processes in plasma. A clear example of this was his paper on the instability mechanism of internal quenching, which elucidated how the magnetic force lines reconnect in such a process (1975) and provided an impetus for a great number of numerical investigations and experiments. Another example was his recent theory of self-organization in tokamak plasma (1986), viewing it as a transition to one of two states of relative energy minima, corresponding to the two observed regimes of "good" and "poor" confinement. B. B. Kadomtsev's description (together with O. P. Pogutse) of the microscopic picture of transport, based on the nonlinear equations of plasma dynamics in a strong magnetic field which he was the first to formulate, proved of great importance, as it agreed with the observed scaling behavior.

B. B. Kadomtsev's unceasing efforts in theoretical physics were complemented by his voluminous administrative and pedagogic activity. From 1973 onward B. B. Kadomtsev has headed the plasma physics department in the I. V. Kurchatov Institute of Atomic Energy, where he directs various research programs and the ongoing development of an experimental thermonuclear reactor. He is an active member of the Editorial Committee of the USSR Academy of Sciences, chairman of the General Scientific Council on coordinated plasma physics research at the USSR Academy of Sciences, editor-in-chief of the *Uspekhi Fizicheskikh Nauk* journal, and editor-in-chief of the physics publications of the All-Union Institute of Scientific and Technical Information (Russian acronym—VINITI). In the course of heading the department of plasma physics and chemistry at the Moscow Physicotechnical Institute, he devotes much effort to the education of undergraduate and graduate students. The lectures he gave in the plasma physics department of the physical and molecular chemistry division in 1976 have served as the foundation of an exhaustive treatise "Collective Phenomena in Plasma" (published by Nauka), which presents the current state of plasma physics in a lively and clear fashion.

Another important facet of B. B. Kadomtsev's scientific activity is his active participation in international cooperation on the problems of controlled thermonuclear fusion. He serves as the chairman of the plasma physics section of the European Physical Society and of the International Scientific Advisory Committee on the INTOR thermonuclar reactor project, developed under the auspices of IAEA. His worldwide reputation secured his election to the Royal Academy of Sciences of Sweden and his honorary degree from the Humboldt University of East Germany (Berlin).

B. B. Kadomtsev is a recipient of the Red Banner of Labor award, as well as the Lenin and State Prizes.

On his sixtieth birthday B. B. Kadomtsev is full of vigor and energy, and it is our heartfelt wish that his creative endeavors continue for many years to come.

Translated by A. Zaslavsky