
YEVGEN DMYTROYCH VOLKOV (03.03.1934–16.01.2012)



On January 16, 2012, Yevgen Dmytrovych Volkov, a known physicist in the fields of confinement and heating of plasma in toroidal magnetic traps and collective phenomena in plasma, died at the age of 78.

Ye.D. Volkov was born on March 3, 1934, at the village of Blizhnepesochnoe (the Nizhegorodskaya region, Russia), in the family of a military man. After finishing the school with a gold medal in the town of Chuguev (the Kharkiv region, Ukraine) in 1952, he entered the Faculty of Physics and Mathematics of the Kharkiv State University with the specialization in nuclear physics.

After graduating from the University in 1957, Ye.D. Volkov came to work at the Physico-Technical institute of the Academy of Sciences of the UkrSSR (now, it is the National Scientific Center “Kharkiv Institute of Physics and Technology”, NSC KIPT). Yevgen Dmytrovych tied all his life with this institute, by actively participating in researches. Already for the first years of

his work, he together with his colleagues discovered the effect of anomalous resistance in plasma.

In 1960, by the initiative of Academician I.V. Kurchatov, the Institute was included into the USSR program on the toroidal magnetic confinement of plasma. Academician K.D. Sinelnikov and the Corresponding Member V.T. Tolok suggested Ye.D. Volkov to head a group aimed at creating the first-in-Ukraine stellarator “Sirius”. This task was successfully executed within an extremely short term, so that the first experiments were started on the “Sirius” as early as at the beginning of 1964.

While constructing this installation, the group of young scientists (P.Ya. Burchenko, V.G. Vasilenko, and V.A. Rudakov) under guidance of Ye.D. Volkov analyzed the results of unsuccessful experiments carried out by American physicists on the first stellarators and formulated the program of stellarator-based researches in Kharkiv. With the help of “Sirius” stellarator, this group proved the necessity of a fine tuning of the magnetic system. For the first time, they measured the limiting gas-kinetic pressure in plasma, at which the equilibrium state of a plasma in the stellarator becomes destroyed, revealed a drift instability of plasma, and showed that this instability is responsible for the anomalously high losses of particles and the plasma energy across the magnetic field.

Another direction of works on the “Sirius” stellarator concerns an anomalous electric conductivity of plasma and its turbulent heating. The application of the current-induced turbulent heating allowed the researchers to obtain plasma temperatures up to 1 keV, which was a record at that time. As a result of this series of experiments, the important conclusions, which opened a new stage of researches dealing with the plasma confinement in stellarators, were drawn. It was revealed that the plasma losses across the magnetic field can be reduced owing to the drift instability stabilization by a magnetic field shear. At lower currents in plasma, the particle losses also diminish. This conclusion brought

the scientists to the necessity to pass to the current-free methods of plasma generation and heating in stellarators. It was shown that the Bohm limit can be substantially exceeded in stellarators for both the plasma and energy lifetimes. Those results were inscribed into the state's register of discoveries under the title "Turbulent heating and anomalous plasma resistance phenomenon" (1972, diploma No. 112).

In 1970, Ye.D. Volkov and O.V. Georgievskiy suggested to create a new stellarator facility at the UPTI, an Uragan-3M torsatron with a divertor, which was first proposed by V.F. Aleksin. In 1974, a laboratory was created for the coordination of works associated with the construction of Uragan-3M torsatron and their scientific support. Ye.D. Volkov was commissioned to manage it. In 1973–1981, a number of works were carried out at this laboratory, which were devoted to the substantiation of the conception of a thermonuclear reactor on the basis of a torsatron with a divertor, and a series of researches was executed concerning the processes of interaction between plasma and the first wall surface in the stellarator. The shift of a plasma filament toward the center was demonstrated to reduce plasma losses. This effect is applied now on the largest-in-the-world stellarator installation, the LHD (Large Helical Device) heliotron in Japan.

For about twenty years, Ye.D. Volkov headed the Department of Stellarators, the largest scientific department at the Institute of Plasma Physics of the NSC KIPT. The main direction of this department consists in carrying out the experimental researches concerning the heating and the confinement of high-temperature plasma in toroidal magnetic traps of the stellarator type. A number of important results were obtained. Namely, the asymmetry of divertor plasma flows was discovered, the Lévy turbulence in peripheral plasma was studied, and the plasma confinement modes were analyzed. Those results were recognized by the world stellarator community.

In 1969, Ye.D. Volkov defended the Candidate's degree thesis entitled "Collective interactions in current-heated plasma in the stellarator", and, in 1992, the Doctor's degree thesis "Collective properties of current-discharge plasma in a stellarator".

Ye.D. Volkov paid much attention to training the scientific staff in the fields of plasma physics and controlled

thermonuclear fusion. Since 1988, he had been lecturing the course "Plasma confinement" to the students of the Chair of Plasma Physics of the Faculty of Physics and Engineering at the V.N. Karazin Kharkiv National University. Now, his disciples, who graduated from this faculty, are working at scientific institutions of Ukraine and abroad. Everywhere, they confirm the high level and the authority of the Kharkiv scientific school of plasma physics.

The results of Ye.D. Volkov's scientific activity found their reflection in 400 publications, including two monographies: E.D. Volkov, N.F. Perepelkin, V.A. Suprunenko, and E.A. Sukhomlin, *Collective Phenomena in Current-Carrying Plasma*, which was published both in Ukraine (Naukova Dumka, Kyiv, 1979) and abroad (Gordon and Breach, New York, 1985), and Ye.D. Volkov, V.A. Suprunenko, and A.A. Shishkin, *Stellarator* (Naukova Dumka, Kyiv, 1983) (in Russian).

The scientific activity of Ye.D. Volkov was awarded three Prizes of Ukraine: the State Prize of Ukraine in science and engineering (2005), the K.D. Sinelnikov Prize of the Academy of Sciences of the UkrSSR for the monography "Stellarator" (1985), and the M. Ostrovskiy Prize (1970). In 1996, he was elected a member of the New York Academy of Sciences. In 2003, he was awarded the sign "Veteran of atomic engineering and industry". For his scientific-pedagogical work, Ye.D. Volkov was given the rank of Soros Professor in 1996, and, in 2003, he was awarded the sign "Honored Worker of Education in Ukraine" of the Ministry of Education and Science of Ukraine.

While communicating with his colleagues, Yevgen Dmytrovych always demonstrated good manners and goodwill under any circumstances, sometimes rather hard. He was always ready to render the necessary help—both at work and beyond. The blessed memory of him will remain forever in our hearts.

*A.G. Zagorodny, I.M. Neklyudov, M.O. Azarenkov,
O.M. Egorov, K.M. Stepanov, V.I. Karas',
V.S. Voitsenya, I.Ye. Garkusha, I.O. Girka,
V.I. Zasenka, I.M. Pankratov*