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Obituary

DMITRII YEVGEN'YEVICH OKHOTSIMSKII (26.2.1921–18.12.2005)☆

Dmitrii Yevgen'yevich Okhotsimskii, the outstanding scientist and organizer in the field of mechanics, mathematics, and control theory, member of the Russian Academy of Sciences, Hero of Socialist Labour, Lenin Prize winner, USSR State Prize winner, S. A. Chaplygin Prize winner, and M. V. Keldysh Gold Medal winner, Professor Emeritus of Moscow State University, and foreign member of the Serbian Academy of Arts and Sciences, died in the night on 17–18 December 2005 after a chronic serious illness. The small planet No. 8061 was named 'Okhotsimskii' after him.

He graduated in 1946 from the Mechanics and Mathematics Faculty of Moscow State University. In the same year, in the journal *Prikladnaya Matematika i Mekhanika*, a paper of his was published in which he proposed an entirely original approach to investigating degenerate variational problems; it immediately attracted the attention of researchers, since it had application to the optimization of missile trajectories.

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He himself recalls [in his contribution 'M. V. Keldysh – scientist, guide, individual' to the book *M. V. Keldysh. A Creative Portrait According to Recollections of His Contemporaries* (Ed. A. V. Zabrodin). Nauka, Moscow, 2001, 328–331]:

> '... After graduating from Moscow State University, I was enrolled as a postgraduate student in the Steklov Institute [MIAN – the V. A. Steklov Mathematical Institute of the USSR Academy of Sciences], and Professor Keldysh became my guide. Fairly soon, research on missiles began at MIAN ... Our initial work was to provide a theoretical basis as to which missiles to make, how to design them, and their potentialities. Keldysh immediately involved me in this work, together with a small team of graduates from the university and other people, which he asked me to assemble. This team included S. S. Kamynin, T. M. Eneyev, and V. A. Yegorov, and later V. A. Sarychev. This was how the cell that worked both on cruise missiles and on ballistic missiles came about. The first investigations and calculations were carried out by us in 1946 ... In 1954, by which time it had already become clear that the space age was approaching, and indeed was already knocking on the door, Keldysh called a meeting of missile technology scientists and supervisors in his work study at our institute, where the study-museum of Academician M. V. Keldysh is now housed. This was a historic meeting! Timur Magometovich Eneyev and I took part in it ...'

It seems that, as a result of a discussion at this meeting with Academician P. L. Kapitsa, the idea came to Okhotsimskii of the passive gravitational stabilization of artificial Earth satellites, i.e. the orientation of satellites by natural forces without any fuel being used to control the orientation. Much later (in 1970), he, together with his team of researchers, was awarded the State Prize for work in this field. The 1950s was a decade of preparation and achievement of the breakthrough into space – years of unprecedented upsurge in scientific research initiated and supervised by Keldysh at the Institute of Applied Mathematics in general, including Okhotsimskii's department. His department followed a triumphal path of innovative scientific achievements aimed at solving specific scientific and technical problems and carried out at the highest scientific level.

The Keldysh–Okhotsimskii school of the dynamics of space flight is now known worldwide. It is worth recalling, for example, the names of the brilliant researchers of moon flight trajectories V. A. Yegorov and M. L. Lidov (alas, both also no longer with us).

The first detailed calculations of the evolution of the trajectories of artificial Earth satellites worldwide were truly epoch-making. Work on this topic by Okhotsimskii, Eneyev, and Taratynova was published in the year of the launch of the first artificial satellite, but several months before the actual launch [in *Uspekhi Fiz. Nauk*, 1957, **63**,1a]. The papers published in this famous issue of the journal signalled to the world that the Soviet Union was ready for practical launches of artificial satellites and spacecraft. This was realized in actual launches in the following months. For work on the launch of the first artificial satellite, Okhotsimskii was awarded the Lenin Prize (1957).

His team took direct part in the preparation and achievement of the first manned space flight and the first automatic apparatus sent to the Moon and planets of the solar system. In this team, 35 first higher degree graduates and 12 doctors of science emerged under his direct guidance; apart from Okhotsimskii himself, one of his colleagues was elected as an academician and one as a corresponding member of the Russian Academy of Sciences.

In the style of his scientific work and leadership, he had a characteristic complete and selfless devotion to the matter in hand, which – as he demanded of himself and of his colleagues – required comprehensive and detailed discussion in order to formulate the problem and establish the methods and objectives for its investigation, and to predict possible and desirable results and methods of optimizing these results.

In 1959, without abandoning his main work at the Institute of Applied Mathematics, he became (on the initiative of N. G. Chetayev) Professor at the Department of Theoretical Mechanics in the Mechanics and Mathematics Faculty of the M. V. Lomonosov Moscow State University, and in 1962 he became Head of this department and directed it until his last days. Under his leadership, the department, which later (in 1999) was renamed the Department of Theoretical Mechanics and Mechatronics, greatly expanded the remit of its activity. He invited to the department a number of his colleagues at the Institute of Applied Mathematics and related organizations. This made it possible to create new lines of research, to introduce new special courses, one of which he took himself, and to interest and attract students, postgraduates, and colleagues in the department to study a wide range of problems of the dynamics and control of vehicles, celestial mechanics, and, later, mechatronics.

In 1970, he instigated research on creating a new type of vehicle – walking vehicle. This topic was widened and became a composite part of the target programme of scientific research in the complex "robotic systems" programme.

The development of methods of controlling six-legged and two-legged walking vehicles was carried out in 1970 at the M. V. Keldysh Institute of Applied Mathematics, the Institute of Mechanics of the Moscow State University, the Institute of Problems of Information Communication, and in the Department of Theoretical Mechanics and Mechatronics of Moscow State University under his leadership. Methods of mathematical modelling based on the use of the latest computer technology were developed. Using these, algorithms were created for plotting the motion of apparatus, making it possible to ensure stability in negotiating obstacles, in jumps, in regular motion, and in manoeuvring. Computer-linked laboratory prototypes of walking vehicles equipped with electromechanical drives and a technical vision system were set up.

Professor Okhotsimskii also carried out a number of other far-reaching studies in the field of mechanics. Together with colleagues, at the start of 1950s, he was the first to carry out a numerical calculation of explosions in the atmosphere taking counterpressure into account, which had great practical importance in the development of nuclear weapons. He analysed the influence of liquid with a free surface on the vibrations of a rigid body in order to estimate the dynamic action of liquid fuel and oxidant onboard a missile on its motion about its centre of mass. He made an interesting and original investigation of the motion of a low-thrust spacecraft with a small thrust in a central field.

In 1998, based at the Institute of Mechanics of the Moscow State University, annual "Mobile Robots" scientific and technical festivals of youth were started, including competitions of smart mobile robots created by teams of students, postgraduates, lecturers, and scientists at various higher educational and scientific establishments. There are also international competitions of this type, at which Russian teams led by him have been successful.

Apart from his direct research and teaching activity, Professor Okhotsimskii managed on an official level to occupy himself with large-scale scientific organizational activity as a member of the National Committee on Theoretical and Applied Mechanics, Chairman of the Scientific and Technical Committee on Robotics and office member of the Russian National Committee for Automatic Control, Deputy Chairman of the Scientific Council of the Russian Academy of Sciences on Robotics and Mechatronics, and Chairman of the Specialized Council on Theoretical Mechanics at the Moscow State University.

Professor Okhotsimskii was an extraordinary man. Demanding, if need be – very demanding in business, mild-mannered and friendly when off duty, ready to share a joke and humorous. His intellectual power and his talent as an organizer were the foundation upon which more than one famous achievement in Russian science was based.

He died just over two months before his eighty-fifth birthday. His passing is an irreplaceable loss to his relatives, friends, and colleagues and for Russian and world science as a whole.

Translated by P.C.