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Leopoldina-Lecture

Professor Zhores I. Alferov

Semiconductor Revolution in the 20th Century

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Professor Zhores I. Alferov

Semiconductor Revolution in the 20th Century

The discovery of the transistor formed the basis for the development of semiconductor electronics in the 20th century. In turn, the discovery itself was based on fundamental semiconductor research: Wilson's band theory, the contact phenomena theory of Shottky and Davydov, photoeffect and tunnelling research of Frenkel and Ioffe. Rapid development of information technologies in the second half of the 20th century mostly relies on silicon microelectronics and semiconductor heterostructures optoelectronics. The progress of the silicon "chips" technology brightly illustrated with Moore's law has resulted in huge microprocessors and computer progress. The development of semiconductor heterostructures has led to the current state of fiber-optics communication, the use of cell phones, CDs, LED lighting and provided a whole laboratory for creation and research of low dimensional electronic gas structures.

Today's birth of nanoelectronics, however, brings forth a problem of setting principal limits for the further compliance with Moore's law. It leads to the origination of new branches of electronics: spintronics, molecular electronics, and quantum logic require decades of research and development. The integration of semiconductor heterostructure photonics with silicon chips will probably become the most promising of its new stages.

Hinweis: Die Veranstaltung findet in englischer Sprache statt.

Zhores Ivanovich Alferov

Vice-President of the Russian Academy of Sciences (RAS)
Chairman of the Saint Petersburg Scientific Center of the RAS
Rector of the Academic University of the RAS

Born on March 15, 1930, in Vitebsk (former USSR, now Belarus), Zhores I. Alferov graduated from the *Leningrad Electrotechnical Institute* in 1952. In January 1953 he became staff member of the *Ioffe Institute*, where he defended his candidate (1961) and doctoral (1970) theses. He became Corresponding Member (1972) and Academician (1979) of the *Russian Academy of Sciences* (RAS). From 1987 to 2003, he was Director of the *Ioffe Institute* in St. Petersburg.

In 2000 he was awarded the Nobel Prize in Physics (together with H. Kroemer) for basic work on information and communication technology, particularly for the development of semiconductor heterostructures used in high-speed and opto-electronics.

As shown theoretically and experimentally in the studies carried out by Zhores I. Alferov at the *Ioffe Institute*, it is possible in a novel way to control fluxes of electrons and photons in semiconductor heterostructures, artificial crystals grown from semiconductors with different chemical compositions. Lasers, light-emitting diodes, photodiodes, transistors and solar cells developed on the basis of heterostructures are universally used in modern systems for information transfer and storage as well as in space power engineering.

Zhores I. Alferov is one of the most prominent organizers of academic science in Russia and proponent of the creation of educational centres at leading institutes of the RAS. He organized an educational centre for physics and technology at the *Ioffe Institute* in 1999 which was transformed into an independent institution affiliated to the RAS in 2004. In 2009 it became the *Academic University – Nanotechnology Research and Education Center* of the RAS.

At present, Zhores I. Alferov is Vice-President of the *Russian Academy of Sciences* (RAS), Chair of the *St. Petersburg Scientific Centre* and Rector of the *St. Petersburg Academic University*.