

SCIENTIFIC PROFILE: Professor Michael A. Liberman

Dr. Michael A. (Mikhail) Liberman is a professor of theoretical physics at the Nordic Institute for Theoretical Physics (Nordita) Royal Institute of Technology and Stockholm University. His scientific interests span from plasma physics to quantum coherence, Bose-Einstein condensation of excitons, combustion theory and astrophysics.

A graduate of Moscow State University, Liberman obtained his PhD from the P.N. Lebedev Physical Institute of Russian Academy of Sciences, commencing his career as a theoretical physicist with the guidance from legendary scientists, Yakov Zel'dovich and Ilia Lifshits at the L. Landau theoretical department of the famous P.L. Kapitza Institute for Physical Problems. During that period, he was awarded his second doctorate degree ('habilitation') at the G.I. Budker Institute of Nuclear Physics. Liberman continues to carry traditions of the Russian theoretical physics throughout his career at Uppsala University and, presently, at Nordita, drawing the most brilliant physicists from around the world into collaboration. In 1993 Liberman was elected professor of theoretical physics at Uppsala University. He is currently a professor at NORDITA, emeritus at Uppsala University, and honorary professor at the Moscow Institute of Physics and Technology.

Dr. Liberman produced hugely influential research in numerous areas of theoretical physics, including physics of shock wave, plasma physics, quantum theory and combustion. His accomplishments include the theory of dynamics and stability of Z-pinches and plasma liners, which also resulted in the development of a new method for production of ultrahigh magnetic field. In collaboration with Sandia National Laboratories, a world record pulsed magnetic field of 43MG was obtained experimentally, which remains the strongest magnetic field to ever be obtained in the laboratory experiments. In quantum mechanics Dr. Liberman obtained an exact analytical solution for a hydrogen atom in a magnetic field of arbitrary strength; and for a hydrogen molecule in ultrahigh magnetic fields; developed theory of the Bose condensate of excitons in semiconductors in a high magnetic field and in a low-dimensional system.

Dr. Liberman is regarded as one of the world's leading scientists in combustion theory. Liberman's major contributions in combustion theory include a comprehensive theory of dynamics and stability of flame, fractal structure of a spherically expanding flame; interaction of flames with acoustic and shock waves; a nonlinear equation for a nonperturbative description of curved premixed flame with arbitrary gas expansion subject to the hydrodynamic instability and its analytical solutions. For the first time he explained the origin and the physical mechanism of the transition from slow combustion (deflagration) to detonation regime and the mechanism of tulip flame formation. Dr. Liberman's recent research is focused on study of key combustion problems with account a detailed chemical kinetics, which led to qualitative and quantitative revision of the combustion fundamentals.

Dr. Liberman authored over 300 peer-reviewed papers and 5 books on shock waves, plasma physics and combustion physics. He also served as a principal investigator on numerous projects for the Swedish National Foundation Research Council, Swedish Energy Agency, Swedish Royal Academy of Sciences, and as a scientific consultant of National laboratories in the USA and global industry.

Prof. Tov Elperin

The Pearlstone Center for Aeronautical Engineering Studies