

Deutsche Forschungsgemeinschaft
Peter the Great St. Petersburg Polytechnic University
Leibniz Lecture



Professor Dr. Wolfgang Ertmer

Institute of Quantum Optics,
Leibniz Universität Hannover

Vice President of the DFG
Gottfried Wilhelm Leibniz Prize, 1997

Date & Time: Friday, April 20, 2018, 10:30 am
Venue: Peter the Great St. Petersburg Polytechnic
University, NIK,
Politekhnikeskaya 29, bld. 11, Saint Petersburg



The lecture will be held in English.

Quantum Metrology at the Quantum Frontiers

About the lecture:

Highly sensitive quantum sensors based on ultra-cold atomic ensembles open new horizons in quantum sensing and quantum metrology. For instance, inertial sensing by atom interferometry or optical atomic clocks benefit strongly from new methods of quantum engineering of the atomic ensembles.

Entanglement, one of the most intriguing features of quantum mechanics, is nowadays a valuable resource for the improved sensitivity of quantum metrology beyond the standard quantum noise limit. Most prominently, quadrature-squeezed and spin-squeezed states are and will be new techniques propelling atom interferometry and atomic clocks to sub-shot-noise performance. Eventually, this will pave the way towards “interaction-free” quantum measurements.

This lecture treats – besides introductory examples – innovative applications and research directions based on these developments and recent breakthroughs. This will include relativistic geodesy, pan-European clock comparisons, fundamental tests in weightlessness and on ground.

About the speaker:

Born in 1949 in Bonn, Wolfgang Ertmer studied Physics at the Rheinische Friedrichs-Wilhelms-Universität Bonn. In 1978 he obtained his doctorate (supervisor Prof. Siegfried Penselin, Bonn) with a thesis about double-resonance hyperfine structure measurement of titanium. From 1982 until 1984 he worked as research fellow resp. visiting scientist at the Joint Institute for Laboratory Astrophysics (JILA), Boulder, Colorado, together with John L. Hall, Nobel Prize laureate 2005. After his return he habilitated in 1985 at the Rheinische Friedrichs-Wilhelms-Universität Bonn. Since 1994 Wolfgang Ertmer is full professor at the Leibniz Universität Hannover. Wolfgang Ertmers main research interests are atomic physics, quantum optics, degenerate quantum gases, quantum metrology, and biophotonics. Since 2007 he is dean of the QUEST-Leibniz Research School (Quantum Engineering and Space-Time Research). Since 2013 Wolfgang Ertmer is Chairman of the Scientific Board of Directors of the Laser Zentrum Hannover e.V.

The **Deutsche Forschungsgemeinschaft (DFG, German Research Foundation)** is the largest independent research funding organisation in Germany. It is an association under German private law. Its member organisations include German universities, non-university research institutions, academies of sciences and humanities, and scientific associations. It serves all branches of science and the humanities by funding research projects and facilitating cooperation among researchers.

The DFG facilitates national and international cooperation among researchers, provides scientific policy advice and fosters relations with the private sector. It also promotes gender equality in the German scientific and academic communities and encourages the advancement and training of early career researchers.

The **Gottfried Wilhelm Leibniz Prize** has been awarded by the DFG every year since 1986 to exceptional scientists and academics for their outstanding achievements in the field of research. This most prestigious research award in Germany aims to improve the working conditions of outstanding scientists and academics, expand their research opportunities, relieve them of administrative tasks, and help them employ particularly qualified early career researchers. A maximum of €2.5 million is provided per award.

The Leibniz Lecture is a format used by the DFG to invite Leibniz Prize laureates for lectures, seminars and visits abroad in order to stimulate dialogue between the laureates and the research community, as well as with the broader public in the host country.

The DFG organises **Leibniz Lectures** in different regions around the world in order to promote German science, especially at locations where it has its own foreign representations, such as in Brazil, Russia, India, China, Japan, and the USA. Germany's scientific relations with Russia are part of a lively, centuries-old tradition. Russia is particularly significant for the German scientific system and is a priority country in the DFG's international activities. The DFG has maintained an intensive scientific dialogue with Russia for decades and, since 2003, has supported the development of bilateral cooperation through its own representative office in Moscow, the **DFG Office Russia/CIS** (<http://www.dfg.de/ru>). As well as being the DFG's liaison office, it functions as a local point of contact for Russian scientists, providing advice and supervising in cooperation programmes.

In 2012, the DFG Office organised the first Leibniz Lecture in Moscow. Since then, the following lectures have been held annually in the Russian Federation:

- 2018: Frank Allgöwer (Institute for Systems Theory and Automatic Control, University of Stuttgart), "Networked Cybernetics: From the Classical Feedback Loop to the New Cybernetics of the 21st Century", German-Russian Institute of Advanced Technologies of KNRTU-KAI, Kazan;
- 2017: Wolfgang Ertmer (Institute of Quantum Optics, Leibniz Universität Hannover), "Cold Atom Based Quantum Metrology", Faculty of Physics, Lomonosov Moscow State University (MSU), Moscow;
- 2016: Hartmut Leppin (Goethe-Universität Frankfurt/Main), "Antikes Christentum und Religiöse Gewalt" (Античное христианство и религиозное насилие), Scientific Library of Lomonosov Moscow State University (MSU), Moscow;
- 2015: Hartmut Leppin (Goethe-Universität Frankfurt/Main), "Demut und Macht: Die christlichen Kaiser der Spätantike (Смирение и власть: императоры-христиане позднего Рима)", Russian State University for Humanities, Moscow;
- 2014: Günter Ziegler (Freie Universität Berlin), "Sugar Cubes, Soap Bubbles, A Revolution and A Star: Some Stellar Images between Mathematics and Physics", Steklov Institute of Mathematics, Saint Petersburg Branch;
- 2013: Günter Ziegler (Freie Universität Berlin), "Cannons at Sparrows: Cutting Polygons via Configuration Spaces", Library Hall, Hotel Balchug, Moscow;
- 2012: Matthias Kleiner (DFG President), "Strategic Research in Engineering – Advanced Light Metal Extrusion for Low Energy Design", Lomonosov Moscow State University, Moscow.