



Klaus von Klitzing



Date of Birth: 28 June 1943

Place: Schroda (Germany)

Nomination: 22 May 2007

Field: Physics

Title: Professor, Nobel laureate in Physics, 1985

Professional address

Max-Planck-Institute for Solid State Research
D-70569 Stuttgart (Fed. Rep. of Germany)

Most important awards, prizes and academies

Awards: Schottky Prize (1981); Hewlett Packard Prize (1982); Nobel Prize in Physics (1985); Dirac Medal (1988); Philip Morris Prize (1990); Eötvös Medal (1994); Award for a Lifetime Achievement in Science, Birla Science Center (1999); Bayerischer Maximiliansorden für Wissenschaft und Kunst; Carl Friedrich Gauß-Medaille (2005). **Honorary doctorates** from Universities in 12 countries. **Memberships:** US National Academy of Sciences; Russian Academy of Sciences; Royal Society of London; Chinese Academy of Science; Ehrenmitglied Deutsche Physikalische Gesellschaft; Russian Metrological Academy; Bayerische Akademie der Wissenschaften; Heidelberg Akademie der Wissenschaften; Deutsche Akademie der Naturforscher Leopoldina; Academia Europea; Austrian Academy of Science; American Physical Society; Korean Academy of Science and Technology; UK Institute of Physics; Singapore Institute of Physics; NTT Basic Research Laboratory Advisory Board; Scientific Committee International Solvay Institutes; Kuratorium Physikalisch-Technische Bundesanstalt Braunschweig; Kuratorium Deutsches Museum München; Board of Directors IBZ University of Stuttgart; Prize Committee 'Innovationspreis der deutschen Wirtschaft'; Jury Member START-Wittgenstein Program Austria; Board of Trustees 'Institute of Advanced Studies' of TUM; Nano Initiative Munich Advisory Board.

Summary of scientific research

Prof. Klitzing was awarded the Nobel Prize for Physics in 1985 for his discovery that under appropriate conditions the resistance offered by an electrical conductor is quantized; that is, it varies by discrete steps rather than smoothly and continuously. Prof. Klitzing demonstrated that electrical resistance occurs in very precise units by using the Hall effect. The Hall effect denotes the voltage that develops between the edges of a thin current-carrying ribbon placed between the poles of a strong magnet. The ratio of this voltage to the current is called the Hall resistance. When the magnetic field is very strong and the temperature very low, the Hall resistance varies only in the discrete jumps first observed by Klitzing. The size of those jumps is directly related to the so-called fine-structure constant, which defines the mathematical ratio between the motion of an electron in the innermost orbit around an atomic nucleus to the speed of light. The significance of Klitzing's discovery, made in 1980, was immediately recognized. His experiments enabled other scientists to study the conducting properties of electronic components with extraordinary precision. His work also aided in determining the precise value of the fine-structure constant and in establishing convenient standards for the measurement of electrical resistance.

Main publications

Series Editor of *Nanoscience and Technology* (Springer); Series Editor of *Springer Series in Solid-State Sciences*; Editor of *Physics and Applications of Quantum Wells and Supelattices* (Plenum Press); Editorial Board, *Superlattices and Microstructures* (Academic Press); Executive Board, *Encyclopedia of Physical Science & Technology* (Academic Press); over 500 publications in scientific journals and conference proceedings, of which the main ones are: von Klitzing, K., Dorda, G., Pepper, M., New Method for High-Accuracy Determination of the Fine Structure Constant Based on Quantized Hall Resistance, *Physical Review Letters* 1980, 45, (6), 494-7; Stein, D., von Klitzing, K., Weimann, G., Electron-Spin Resonance

on GaAs-AlGaAs Heterostructures, *Physical Review Letters* 1983, 51, (2), 130-3; von Klitzing, K., The Quantized Hall-Effect, *Reviews of Modern Physics* 1986, 58, (3), 519-31; Dohers, M., von Klitzing, K., Weimann, G., Electron-Spin Resonance in the Two-Dimensional Electron Gas of GaAs-AlGaAs Heterostructures, *Physical Review B* 1988, 38, (8), 5453-6; Weiss, D., von Klitzing, K., Ploog, K., Weimann, G., Magnetoresistance Oscillations in a Two-Dimensional Electron-Gas Induced by a Submicrometer Periodic Potential, *Europhysics Letters* 1989, 8, (2), 179-84; Blick, R.H., Pfannkuche, D., Haug, R.J., von Klitzing, K., Eberl, K., Formation of a coherent mode in a double quantum dot, *Physical Review Letters* 1998, 80, (18), 4032-5; Mani, R.G., Smet, J.H., von Klitzing, K., Narayanamurti, V., Johnson, W.B., Umansky, V., Zeroresistance states induced by electromagnetic-wave excitation in GaAs/AlGaAs heterostructures, *Nature* 2002, 420, (6916), 646-50; Kukushkin, I.V., Smet, J.H., von Klitzing, K., Wegscheider, W., Cyclotron resonance of composite fermions. *Nature* 2002, 415, (6870), 409-12; Kukushkin, I.V., Akimov, M.Y., Smet, J.H., Mikhailov, S.A., von Klitzing, K., Aleiner, I.L., Falko, V.I., New type of B-periodic magneto-oscillations in a two-dimensional electron system induced by microwave irradiation. *Physical Review Letters* 2004, 92, (23); von Klitzing, K. (2005), '25 years of quantum hall effect (QHE) a personal view on the discovery, physics and applications of this quantum effect', *Quantum Hall Effect: Poincare Seminar* 2004 45, 1-21; Kukushkin, I.V., Smet, J.H., Abergel, D.S.L., Fal'ko, V.I., Wegscheider, W., von Klitzing, K., Detection of the electron spin resonance of two-dimensional electrons at large wave vectors. *Physical Review Letters* 2006, 96, (12); Hubel, A., Held, K., Weis, J., Von Klitzing, K. (2008), Correlated Electron Tunneling through Two Separate Quantum Dot Systems with Strong Capacitive Interdot Coupling, *Physical Review Letters* 101(18), 186804; Martin, J., Akerman, N., Ulbricht, G., Lohmann, T., Smet, J.H., Von Klitzing, K., Yacoby, A. (2008), Observation of electron-hole puddles in graphene using a scanning single-electron transistor, *Nature Physics* 4(2), 144-8; Kukushkin, I.V., Smet, J.H., Scarola, V.W., Umansky, V., von Klitzing, K. (2009), Dispersion of the Excitations of Fractional Quantum Hall States, *Science* 324(5930), 1044-7; Lohmann, T., von Klitzing, K., Smet, J.H. (2009), Four-Terminal Magneto-Transport in Graphene p-n Junctions Created by Spatially Selective Doping, *Nano Letters* 9(5), 1973-9; Yoon, Y., Tiemann, L., Schmult, S., Dietsche, W., von Klitzing, K., Wegscheider, W. (2010), Interlayer Tunneling in Counterflow Experiments on the Excitonic Condensate in Quantum Hall Bilayers, *Physical Review Letters* 104(11), 116802; Weis, J., von Klitzing, K. (2011), Metrology and microscopic picture of the integer quantum Hall effect, *Philosophical Transactions of the Royal Society A-mathematical Physical and Engineering Sciences* 369(1953), 3954-74.