



Prof. Klaus von Klitzing

Professor, Nobel laureate in Physics, 1985



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); Österreichisches Ehrenzeichen für Wissenschaft und Kunst (2009), TUM Distinguished Affiliated Professor (2011), Orden Pour le mérite für Wissenschaft und Künste (2019). *Honorary doctorates* from Universities in 13 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; Bulgarian Academy of Sciences; Bayerische Akademie der Wissenschaften; Heidelberg Akademie der Wissenschaften; Deutsche Akademie der Naturforscher Leopoldina; 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; Honorary Member of the International Solvay Institutes; Ehrenkurator Physikalisch-Technische Bundesanstalt Braunschweig; Kuratorium Deutsches Museum München; EURAMET Research Council; Scientific Advisory Council Graphene Flagship; Academia Paraense de Ciências (APC), Seção de Ciências Físicas; Hall-of-Fame der deutschen Forschung; Honorary Research Fellow of the Korean Research Institute of

Standards and Science; IAS Senior Fellow, City University of Hong Kong; WPI Program Committee; Distinguished member of the KAIST Presidential Advisory Council.

Summary of scientific research

Prof. Klitzing was awarded the Nobel Prize for Physics in 1985 for his discovery of the quantized Hall resistance. Prof. Klitzing demonstrated that electrical resistance occurs in very precise units by using the Hall effect in two-dimensional conductors. The Hall effect denotes the voltage that develops between the edges of a current-carrying ribbon placed between the poles of a 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 in discrete jumps, first observed by Klitzing. The value of the fundamental quantized resistance is extremely precise, internationally known as von Klitzing constant. The significance of Klitzing's discovery, made in 1980, was immediately recognized and triggered the introduction of a new international system of units based on constants of nature. The quantum Hall effect has connections to nearly all areas in physics, starting from quarks in high energy physics to black holes in astrophysics and is regarded as the first topological insulator. In general, von Klitzing's research includes optical and transport measurements on semiconductor quantum structures.

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 Superlattices* (Plenum Press); Editorial Board, *Superlattices and Microstructures* (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-AlGa_{1-x}As 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; Doherty, M., von Klitzing, K., Weimann, G., Electron-Spin Resonance in the Two-Dimensional Electron Gas of GaAs-AlGa_{1-x}As 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; K. Panos, R.R. Gerhardt, J. Weis, and K. von Klitzing, Current distribution and Hall potential landscape towards breakdown of the quantum Hall effect: a scanning force microscopy investigation, [*Physical Review Letters* 2014, 113, 076804](#). B. Friess, V. Umansky, L. Tiemann, K. von Klitzing, and J. Smet, Probing the Microscopic Structure of the Stripe Phase at Filling Factor 5/2, [*Physical Review Letters* 2014, 113, 076803](#), S. Dorozhkin, V. Umansky, L. Pfeiffer, K. West, K. Baldwin, K. von Klitzing, and J. Smet, Random Flips of Electric Field in Microwave-Induced States with Spontaneously Broken Symmetry, [*Physical Review Letters* 2015, 114, 176808](#), D. Zhang, W. Dietsche, and K. von Klitzing, Anomalous Interlayer Transport of Quantum Hall Bilayers in the Strongly Josephson-Coupled Regime, [*Physical Review Letters* 2016, 116, 186801](#), K. von Klitzing, Quantum Hall Effect: Discovery and Application, [*Annual Review of Condensed Matter Physics* 2017, 8, 13-30](#), K. von Klitzing, Metrology in 2019, *Nature Physics* 2017, Vol 13, 198, B. Friess, V. Umansky, K. von Klitzing, and J.H. Smet, Current Flow in the Bubble and Stripe Phases, [*Physical Review Letters* 2018, 120, 137603 1-6](#), Joseph Falson, Daniela Tabrea, Ding Zhang, Inti Sodemann, Yusuke Kozuka, Atsushi Tsukazaki, Masashi Kawasaki, Klaus von Klitzing, and Jurgen H. Smet, A cascade of phase transitions in an orbitally mixed half-filled Landau level, [*Science Advances* 2018, Vol. 4, no. 9, eaat8742](#), Klaus von Klitzing, Quantum Hall Effect and the New International System of Units, *Phys. Rev. Lett.* 2019, 122, 200001.