Leo P. Kouwenhoven

Kavli Institute of Nanoscience, Faculty of Applied Sciences,
Delft University of Technology
P.O. Box 5046, 2600 GA Delft, The Netherlands
Phone: +31 15 2786064
E-mail: L.P.Kouwenhoven@tudelft.nl; URL: http://kouwenhovenlab.tudelft.nl/

Personal details
Date of birth: 10 December 1963
City of birth: Pijnacker (The Netherlands)
Nationality: Dutch

Employment
Present position:

- Full Professor of Physics at the TU Delft since 1999. Since 2007 appointed as "Distinguished Professor" (Universiteitshoogleraar, which is an honorary title given by TU Delft to only two of its research staff in recognition of outstanding achievements.)
- Founding director of QuTech, the Advanced Research Center on Quantum Technologies.

Past positions:

- 2013 Chair of the Department of Quantum NanoScience at TU Delft.
- 2004-2013 Programme leader of the Dutch Concentration group on "Solid State Quantum Information Processes", a ten-year 1 M€/year National programme sponsored by the Dutch National Science Foundation (NWO/FOM).
- 2000-2001: Visiting Professor at the Physics Department of Harvard University (USA)
- 1993-1998: Academy researcher at the Royal Netherlands Academy for Arts and Sciences
- 1992-1994: Postdoc with Prof.dr. Paul McEuen at the University of California at Berkeley (USA)
- 1991: Visiting scientist with Prof.dr. Hiroyuki Sakaki at the University of Tokyo (Japan)

Education

- 1992: PhD Degree *cum laude* from Delft University of Technology. Supervisor: Prof.dr. J.E. Mooij
  Thesis: *Transport properties of electron-waves and single-charges in semiconductor nanostructures*
- 1988: MSc Degree in Applied Physics from Delft University of Technology.
  Main subject: *Discovery of quantized conductance in quantum point contacts*.

Awards and honors

- 2013 ERC Synergy Grant (together with Vandersypen and Beenakker)
- 2012 AAAS Newcomb Cleveland Prize for "An innovative approach in nanoscience to detect the presence of exotic quasiparticles, known as Majorana fermions"
- 2012 Genootschapsmedaille. Medal from the Society "Genootschap ter bevordering van Natuur-, Genees- en Heelkunde" See http://gngh.uva.nl/onderscheidingen/genootschapsmedaille/genootschapsmedaille.html
- 2012 Stokvispenning. Medal from the Society "Nederlandsch Natuur- en Geneeskundig Congres, *De Stokvispenning*"
- 2009: Physica Prize of the Dutch Physics Association (NNV)
- 2008: ERC Advanced Investigator Award
- 2008: Best Teacher Award (Leermeester prijs) awarded annually to one professor at TU Delft.
- 2007: Elected as Fellow of the School of Engineering at University of Tokyo. Honorary title in recognition of a long and successful collaboration.
- 2007: Spinoza Award. Equivalent to M€ 1.5; the most important Dutch scientific honor, awarded to outstanding, pioneering and inspiring scientific work.
- 2002: VICI award. Equivalent to M€ 1.2 as part of the Innovation Research Incentives Scheme of the Netherlands Organisation for Scientific Research.
- 2002: Sackler Prize for Physics, equivalent to $50.000, shared with U. Steiner (awarded at Tel Aviv University).

- 2001: Quantum Devices Award from the 28th International Symposium on Compound Semiconductors; equivalent to $8.000, shared with M. Reed and S. Tarucha.
- 1993: Shell Prize for young researchers
- 1992: TALENT-stipendium from the Dutch National Science Foundation for 1-year travel support
- 1990: Young-Author/Best-Paper-Award at the 20th International Conference on the Physics of Semiconductors, Thessaloniki, Greece

Academy Memberships
- Member of the Netherlands Academy of Technology and Innovation (ACTI-nl)
- Member of the Royal Netherlands Academy of Arts and Sciences (KNAW)
- Member of Koninklijke Hollandsche Maatschappij der Wetenschappen (Royal Dutch Society for the Sciences)
- Honory member of Royal Institute for Engineers (KIVI).

Professional activities
- Member of the Board of Governors of the Dutch Foundation for Fundamental Research of Matter (FOM)
- Member of the Advisory Council of the Dutch Topsector "High Tech"
- Member of the (continuous) Evaluation Boards of ETH Zürich, Max-Planck-Institut Stuttgart
- Consultant Researcher Microsoft Station Q

International activities
International Grants have been received from the EU (various programs), Japan Science and Technology (NEDO, ERATO, SORST and ICORP) and from the USA (ARO, ONR, NSF, DARPA). Official collaborations via grants with publications or student exchange exists with groups from Tokyo, Princeton, Illinois, Harvard, Basel, Lund, Madrid, Hamburg, Max Planck Institute Stuttgart, Munich, and Genoa.

- 2001-2010: International partner of the NanoScience Center at Harvard University (USA). In this collaboration students from Harvard can visit Delft and vice versa.
- 1999-2009: Research collaboration with Prof.dr. Seigo Tarucha from Tokyo University sponsored by the Japanese Science and Technology agency JST.

Output in numbers
- (Co-)authored more than 240 papers (see http://kouwenhovenlab.tudelft.nl/publications/)
- Publications include 21 papers in the Nature-family, 14 papers in Science and 34 papers in Physical Review Letters.
- H-index: 62 and Sum of Times Cited : 19185
- Current PhD students: 10 past PhD students: 27
- About 15 invited lectures at international conferences per year.
- Public lectures are available online including several popular ones on YouTube (e.g. under TEDxDelft).

Scientific breakthroughs
In the area of low-dimensional semiconductor structures, Kouwenhoven has developed a coherent research program. The following publications have been acknowledged as breakthroughs in his field of research:

(i) Quantized conductance. As an undergraduate student Kouwenhoven was the first to measure the quantization of conductance in point contacts. The paper in Phys. Rev. Lett., co-authored by Kouwenhoven has been cited nearly 2000 times.

(ii) Single electron tunneling. After the realization of the single-electron transistor in Aluminum, Coulomb blockade effects in semiconductors were demonstrated at MIT and soon after by Kouwenhoven, who also pioneered the single-electron turnstile.

(iii) Artificial atoms. In collaboration with Tarucha from NTT in Japan, Kouwenhoven showed that the electronic structure in 2D semiconductor disks is analogous to atomic energy spectra, including a periodic table of 2D elements. These structures are now generally referred to as artificial atoms.

(iv) Tunable Kondo effect. Following work at MIT, Kouwenhoven studied various realizations of artificial magnetic impurity systems (Science 1998). New types of Kondo effects were found involving spin singlet-triplet states (Nature 2000 and Science 2000) and orbital degrees of freedom (Nature 2005).

(v) *Spin qubits*. The Kouwenhoven group has two highly influential papers on single-electron spins. First, they demonstrated a single-shot electrical determination of the spin state of an individual electron, without any form of ensemble averaging (Nature 2004). Second, the spin of individual electrons was put in a quantum superposition of up and down by an on-chip ESR technique (Nature 2006).

(vi) *Theoretical proposals*. Kouwenhoven has two influential theoretical proposals. In 1992 he was sole author of a paper describing the connection between single photons and single electrons or holes. This is in fact the first paper in the literature on on-demand single electron to single photon conversion. Secondly, Kouwenhoven published in Phys. Rev. Lett. a scheme to measure quantum noise using quantum dots. This turned out to be only the second paper in the literature describing non-symmetrized quantum noise in electrical conductors. Later, Kouwenhoven was the first to demonstrate this quantum noise (Science 2003).

(vii) *Nanowires*. Bakkers and Kouwenhoven have jointly developed various semiconductor nanowires with applications for quantum optics and quantum transport. One of the outcomes has been induced superconductivity in InAs (Science 2005) and InSb nanowires (including the realization of a pi-junction; Nature 2006). Another result is the realization of a spin-orbit qubit in nanowires (Nature 2010). These results are currently the basis for the search of Majorana Fermions.

(vii) *Majorana Fermions.* The Kouwenhoven group were the first to report experimental signatures of Majorana Fermions in nanoscale electronic devices (Science 2012).