# Curriculum Vitae
# Anton Zeilinger

Born on May 20th, 1945 in Ried/Innkreis, Austria

Present addresses: Faculty of Physics, University of Vienna
Boltzmanngasse 5, 1090 Vienna, Austria

Institute for Quantum Optics and Quantum Information
Austrian Academy of Sciences
Boltzmanngasse 3, 1090 Vienna, Austria

anton.zeilinger@univie.ac.at

## EDUCATION

| | |
|---|---|
| 1979 | Habilitation, Technical University Vienna |
| 1971 | Ph.D., University of Vienna, thesis on "Neutron Depolarization in Dysprosium Single Crystals" under Prof. H. Rauch |
| 1963-1971 | Study of Physics and Mathematics, University Vienna |
| 1963 | Matura (School Leaving Examination), Bundesgymnasium Wien 13, Fichtnergasse 15, Vienna |

## PROFESSIONAL CAREER

| | |
|---|---|
| 2004-present | Scientific Director, IQOQI<br>Institute of Quantum Optics and Quantum Information,<br>Austrian Academy of Sciences, Vienna |
| 1999-present | Full Professor of Experimental Physics, University of Vienna |
| 1990-1999 | Full Professor of Experimental Physics, University of Innsbruck |
| 1988-1989 | Full Professor of Physics (Lehrstuhlvertretung),<br>Technical University of Munich |
| 1983-1990 | Associate Professor, Technical University of Vienna |
| 1981-1983 | Associate Professor of Physics, M.I.T. (Visiting) |
| 1972-1981 | Research Assistant (Senior), Atominstitut Vienna<br>with Professor Helmut Rauch |

## VISITING RESEARCH AFFILIATIONS

| | |
|---|---|
| 2001-2004 | Senior Humboldt Fellow, Humboldt University, Berlin, Germany |
| 1998 | Visiting Research Fellow, Merton College, Oxford University, UK |
| 1995 | Chaire Internationale, Collège de France, Paris, France |
| 1986-1989 | Adjunct Full Professor, part-time, Hampshire College, Amherst, USA |
| 1983-1990 | Regular summer research appointments at M.I.T., USA |
| 1977-1978 | Fulbright Fellow, Research Associate at M.I.T. in the Neutron Diffraction Laboratory under Prof. C.G. Shull (Nobel Laureate 1994), USA |
| 1974-1989 | Guest Researcher (part-time), Institut Laue-Langevin, Grenoble, France |

## DISTINGUISHED LECTURESHIPS

| | |
|---|---|
| 2010 | Celsius Lecture, Uppsala University |
| 2009 | Carl Friedrich von Weizsäcker Lectures, University of Hamburg |
| 2009 | Lecture, 150th birthday of Max Planck, Max Planck Society, German Physical Society, Berlin-Brandenburgische Academy of Sciences, Humboldt University Berlin, Germany |
| 2009 | First Kavli Colloquium, Kavli Institute of Nanoscience, Delft University of Technology, Netherlands |
| 2009 | PITP Lecture on Quantum Phenomena, Pacific Institute of Theoretical Physics, Vancouver, Canada |
| 2008 | Asher Perez Memorial Lecture, Technion, Haifa, Israel |
| 2007 | Wolfgang-Paul Lecture, Bonn University, Germany |
| 2006 | Barut Memorial Lect., Bogazici University, Istanbul, Turkey |
| 2006 | Rosenthal Lecture, Yale University, USA |
| 2006 | Johannes Gutenberg Lecture, Mainz University, Germany |
| 2003 | Angström Lecture, Uppsala University, Stockholm, Sweden |
| 2003 | Amos de-Shalit Memorial Lecture, Weizmann Institute, Rehovot, Israel |
| 2003 | Solly Cohen and Shimon Offer Memorial Lecture, Racah Institute of Physics, Hebrew University of Jerusalem, Israel |
| 2003 | Schrödinger Lecture, Imperial College, London, UK |
| 2003 | Niels Bohr Lecture, Copenhagen University, Denmark |
| 2002 | Chemerda Lecture, Pennsylvania State University, USA |
| 1999 | Schrödinger Lecture, Trinity College, Dublin, Ireland |
| 1997 | H.L. Welsh Lecture in Physics, University of Toronto, Canada |
| 1984 | Sir Thomas Lyle Fellow, University of Melbourne, Australia |

## DISTINGUISHED MEMBERSHIPS

| | |
|---|---|
| 2009 | Foreign Member, Académie des Sciences, Institut de France |
| 2006 | Foreign Member, Serbian Academy of Sciences and Arts |
| 2005 | Honorary Member, Slovak Academy of Sciences |
| 2005 | Member, German Academy of Sciences Leopoldina |
| 2002 | Member, Berlin-Brandenburg Academy of Sciences |
| 2000 | Member, Academia Scientiarum et Artium Europaea |
| 1999 | Fellow, American Physical Society |
| 1998 | Full Member, Austrian Academy of Sciences |
| 1994 | Corresponding Member, Austrian Academy of Sciences |

## HONORARY PROFESSORSHIPS AND DOCTORATES

| | |
|---|---|
| 2006 | Honorary Doctorate, Gdansk University, Poland |
| 2005 | Honorary Doctorate, Humboldt University Berlin, Germany |
| 1996 | Honorary Professor, University of Science and Technology of China |

## INTERNATIONAL PRIZES AND AWARDS

| | |
|---|---|
| 2010 | Wolf-Prize in Physics, Wolf Foundation, Israel |
| 2009 | Great Cross of Merit with Star of the Federal Republic of Germany |
| 2008 | Quantum Communication Award, Tamagawa University, Japan |
| 2008 | Isaac Newton Medal, Institute of Physics, UK |
| 2007 | Quantum Electronics Prize, European Physical Society |
| 2005 | King Faisal Prize, King Faisal Foundation, Saudi Arabia |
| 2005 | Descartes Prize, European Commission |
| 2004 | Lorenz-Oken-Medal, Society of German Researchers and Physicians, Germany |
| 2004 | Klopsteg Award, American Association of Physics Teachers, USA |
| 2003 | Sartorius Prize, Göttingen Academy of Sciences, Germany |
| 2001 | Order Pour le Mérite for Sciences and Arts, Germany |
| 2000 | Senior Humboldt Fellow Prize, Alexander von Humboldt-Stiftung, Germany |
| 1997 | European Optics Prize, European Optical Society |
| 1996 | European Lecturer, European Physical Society |
| 1995 | Prix Vinci d'Excellence, Fondation LVMH, Paris, France |

## AUSTRIAN PRIZES AND AWARDS

| | |
|---|---|
| 2006 | Grand Gold Decoration, City of Vienna |
| 2005 | Wilhelm-Exner-Medal, Austrian Association for Enterprises |
| 2002 | Johannes Kepler-Prize, Science Prize of Upper Austria |
| 2001 | Decoration of Sciences and Arts (Austrian equivalent to the Order of Merit) |
| 2001 | Visionary of the Year in Science |
| 2000 | Science Prize, City of Vienna |
| 1997 | Kardinal Innitzer Würdigungspreis, Vienna |
| 1996 | Austrian Scientist of the Year |
| 1980 | Prize of the Theodor Körner Foundation, Vienna |
| 1979 | Prize for Junior Scientists, Kardinal Innitzer Foundation, Vienna |
| 1975 | Prize of the City of Vienna for the Encouragement of Young Scientists |

## ADMINISTRATION AND COMMUNITY SERVICES

| | |
|---|---|
| 2009-present | President, International Science Academy Traunkirchen, Austria |
| 2008-present | Member, Planning and Strategy Committee of the Austrian Academy of Sciences |
| 2006-present | Vice Chair, Board of Trustees, Institute of Science and Technology of Austria |
| 2006-present | Member, Executive Board, Institute of Science and Technology of Austria |
| 2006-2009 | Dean of the Faculty of Physics, University of Vienna |
| 2004-present | Scientific Director, Institute of Quantum Optics and Quantum Information Vienna, Austrian Academy of Sciences |
| 2002-2003 | Member, Founding Convent, University of Vienna, Austria |
| 2002 | Initiator of a new Postgraduate Research Institution which has been implemented as Institute of Science and Technology in Austria |
| 1997-1998 | President, Austrian Physical Society |
| 1996-1998 | Member, Quantum Electronics and Optics Division, European Physical Society |
| since 1994 | Member, Editorial Board, Physical Review A |
| since 1988 | Member, Editorial Board, Foundations of Physics-Letters |

## RESEARCH INTERESTS

- Fundamental investigations in Quantum Physics, experiment and theory
- Tests of Quantum Mechanics
- Entanglement and Quantum Nonlocality
- Coherent Neutron and Atom Optics
- Atom Interferometry
- Quantum Cryptography
- Quantum Communication
- Quantum Computation
- Quantum Teleportation
- Einstein-Podolsky-Rosen Paradox
- Decoherence

## MAJOR RESEARCH ACHIEVEMENTS

### General Physics and Theory

- Generalized Aharonov-Bohm Effects for Time-Dependent Potentials
- First Papers ever published on Quantum Cellular Automata
- Invention of First Einstein-Podolsky-Rosen Experiment Based on an External Variable (Momentum) Instead of an Internal One (e.g. Spin)
- Discovery of Three-Particle Entanglement as an Extreme Demonstration of Quantum Non-Locality (GHZ)
- Discovery of Entanglement Swapping, the Teleportation of Entanglement
- Identification of Information as the Fundamental Concept in Quantum Physics
- Precision Tests of Quantum Mechanics

### Neutron Interferometry and Neutron Optics

- Demonstration of Spinor Symmetry using a Neutron Interferometer
- Young's Experiment with Neutrons
- Measurement of the Magnetic Neutrality of the Neutron
- Observation of the Anomalous Effective Mass of Neutrons
- Tests of the Linearity and the Unitarity of the Schrödinger Equation

## Atom and Molecule Optics, Mesoscopic Physics

- Dynamical Diffraction of Atoms at Thick Light Crystals
- Diffraction of Atoms at a purely Imaginary Potential (On-Resonant Light Field)
- Anomalous Transmission of Atoms through Light Fields
- Coherent Side-Band Modulation of Atomic DeBroglie Waves
- Development of an Atom Interferometer with Gratings of Light
- Development of a Nanometer Mask made of Light for Atoms
- Development of a Moiré Accelerometer and Rotation Sensor using Atoms
- Diffraction of Atoms at Complex $e^{iGx}$ and $e^{i\omega_t}$ Potentials
- Observation of a Violation of Friedel's Law with Atoms
- Coherent Diffraction of Atoms at Light Crystals in the Channeling Limit
- Atom Holography
- Quantum Physics with Macromolecules and Mesoscopic Systems
- Development of a Macromolecule Interferometer
- Quantum Interference of C-60 and C-70 Molecules
- Quantum Interference of of Porphyrine, a biological molecule
- Clarification of Decoherence Mechanisms in Macromolecule Interference
- Detailed Investigation of the Quantum-Classical Transition
- First Demonstration of the Cooling of a Mesoscopic System by Radiation Pressure

## Fundamental Physics with Entangled Photons

- Development of a Novel High-Intensity Source for Polarization-Entangled Photon Pairs
- Observation of a Violation of Bell's Inequality by more than 100 Standard Deviations
- Two-Photon Quantum Eraser Experiments
- Young's Experiment with Photons with High Precision
- Measurement of Pendellösung for Single Photons and for Entangled Photon Pairs
- Experimental Demonstration of Interaction-Free Measurement
- Entangled Entanglement
- Demonstration of Two-Photon Antibunching at a Beam Splitter
- A Double-Slit Heisenberg Microscope Experiment with Photon Pairs
- First Experimental Quantum Teleportation
- Long-Distance Test of Bell's Inequality under Einstein Locality Conditions
- Realization of Multi-Photon Entanglements (GHZ-states)
- Demonstration of GHZ Nonlocality
- Entanglement of the Orbital Angular Momentum of Photons
- Tests of a Leggett-type Nonlocal Hidden Variable Theory
- Nonlocal Delayed-Choice Experiments with Entangled Photons

**Quantum Information, Quantum Communication and Quantum Computation**

- Verification of Quantum Dense Coding
- Teleportation of an Entangled Photon
- Experimental Entanglement Swapping
- Development of an Entangled-State Quantum Cryptography System
- Demonstration of Purification of Entangled Pairs
- First Quantum Cryptography with Entangled Photons
- First Experimental Realization of the One-Way Quantum Computer
- Grover's Search Algorithm on a One-Way Quantum Computer
- One-Way Quantum Computation with Active Feed-Forward
- Long-Distance Teleportation Across the River Danube
- Quantum Cryptography Over 144 km
- Detection of Single Photons Returning from a Satellite
- Realization of Quantum Games on a One-Way Quantum Computer

## SCIENTIFIC PUBLICATIONS

More than 430 scientific publications among those, more than 300 in peer reviewed, ISI ranked journals

More than 700 invited talks at conferences and seminars

Some papers have become science citation classics. The paper "Experimental Quantum Teleportation" (Nature 390, 1997) has been cited more than 1.600 times so far (ISI Citation Index).

## BOOKS

*Frontiers of Neutron Scattering*
In honour of Clifford G. Shull on the occasion of his 70$^{th}$ birthday
Editors: R. J. Birgenau, D. E. Moncton, A. Zeilinger
Elsevier Science / North-Holland Publishing Division 1986

*New Techniques and Ideas in Quantum Measurement Theory*
Annals of the New York Academy of Sciences, Vol. 480
Editors: D. M. Greenberger, A. Zeilinger
New York Academy of Sciences 1987

*Matter Wave Interferometry*
On the occasion of the 100$^{th}$ anniversary of E. Schrödinger's birth
Editors: G. Badurek, H. Rauch, A. Zeilinger
Elsevier Science / North-Holland Publishing Division 1988

*Fundamental Problems in Quantum Theory*
In Honor of Professor John A. Wheeler
Annals of the New York Academy of Sciences, V. 755
Editors: D. M. Greenberger, A. Zeilinger
New York Academy of Sciences 1995

*Epistemological and Experimental Perspectives on Quantum Physics*
Vienna Circle Institute Yearbook, Volume 7
Editors: D. Greenberger, W. L. Reiter, A. Zeilinger
Kluwer Academic Publishers 1999

*The Physics of Quantum Information*
*Quantum Cryptography, Quantum Teleportation, Quantum Computation*
Editors: D. Bouwmeester, A. Ekert, A. Zeilinger
Springer 2000

*Quantum Information*
*An Introduction to Basic Theoretical Concepts and Experiments*
Springer Tracts in Modern Physics, Volume 173
Editors: G. Alber, T. Beth, M. Horodecki, P. Horodecki, R. Horodecki, M. Rötteler, H. Weinfurter, R. Werner, A. Zeilinger
Springer 2001

*Quantum Computation and Quantum Information Theory*
Editors: C. Macchiavello, G.M. Palma, A. Zeilinger
World Scientific Publishing 2001

*Quantum [Un]speakables, From Bell to Quantum Information*
Editors: R. A. Bertlmann, A. Zeilinger
Springer 2002

**Popular science books**

Both books appeared in German. Translations into other languages have appeared or are currently in preparation.

*Einsteins Schleier*
A. Zeilinger
C.H. Beck 2003

*Einsteins Spuk*
A. Zeilinger
Bertelsmann 2005