Leopoldina
Nationale Akademie
der Wissenschaften

Curriculum Vitae Prof. Dr. Christine Silberhorn

Name: **Christine Silberhorn**
Born: **19 April 1974**

Research Priorities: quantum optics, properties of light, quantum communication, optical components, quantum devices

Christine Silberhorn is a physicist. Her research focus is experimental quantum optics. She studies light and its exceptional properties. Together with her research group she has demonstrated many characteristic quantum properties of light. Beyond that, she develops optical systems for applications in quantum technology. Her research contributes to the understanding of quantum theory and the development of new quantum devices.

Academic and Professional Career

since 2010	Full Professor of Applied Physics/Integrated Quantum Optics, Paderborn University, Germany
2009 - 2010	Head of an independent Max Planck Research Group, Integrated Quantum Optics, Max Planck Institute for the Science of Light, Erlangen, Germany
2008	Habilitation in Experimental Physics, University of Erlangen-Nuremberg, Germany
2005 - 2008	Head of an independent Max Planck Junior Research Group, Integrated Quantum Optics, Max Planck Institute for Quantum Optics, Garching/Munich, Germany
2005	Research Assistant, Max Planck Research Group, Institute of Optics, Information and Photonics, Erlangen, Germany
2003 - 2004	Post-doctoral Research Assistant at University of Oxford, Clarendon Laboratory, and Junior Research Fellow at Wolfson College, Oxford, UK
2003	Doctorate, Chair of Optics, University of Erlangen-Nuremberg, Germany

1999 - 2002 Research Assistant, Chair of Optics, University of Erlangen-Nuremberg, Germany

1993 - 1999 Study of physics and mathematics, University of Erlangen-Nuremberg, Germany

Functions in Scientific Societies and Committees

since 2023 Member of the German Science and Humanities Council

2015 - 2018 Vice President for Research and Junior Academics, Paderborn University, Germany

2007 Board Member of Die Junge Akademie, Germany

Project Coordination, Membership in Collaborative Projects

2018 - 2021 Project B05 (project area B – materials) "Tailored KTP and LiNbO3 waveguide structures for counter-propagating parametric down-conversion processes" and Project C01 (project area C – functional structures) "Engineered frequency conversion devices" and Project C02 (project area C – functional structures) "Integrated SU(1,1) interferometers" and in the framework of DFG funded SFB TRR 142 "Tailored nonlinear photonics: from fundamental concepts to functional structures"

2017 - 2022 ERC Consolidator Grant, EU Horizon 2020, QUPOPCORN: Quantum Particles on Programmable Complex Reconfigurable Networks

2017 - 2020 DFG project "Integrated quantum light sources for continuous variable systems"

2015 - 2018 Partner of EU-Project, Horizon 2020, QCUMbER: Quantum Controlled Ultrafast Multimode Entanglement and Measurement"

2015 - 2018 Partner of EU-Project, Horizon 2020, QUCHIP: Quantum Simulation on a Photonic Chip

2014 - 2017 Project C01 (project area C – functional structures) "Direct measurement of time-frequency shaped ultrafast quantum pulses from parametric down-conversion and up-conversion processes" and Project C02 (project area C – functional structures) "Monolithic integration of a parametric down-conversion source and a two-photon interferometer" in the framework of DFG funded SFB TRR 142 "Tailored nonlinear photonics: from fundamental concepts to functional structures"

2014 - 2018 BMBF project, Q.com-Q: "Quantum Repeater" – subproject "Development of monolithic KTP waveguides devices bridging the wavelengths between stationary and flying Qubits"

2013 - 2017 Partner of EU-Project, FP 7, PICQUE: Photonic Integrated Compound Quantum Encoding

2013 - 2016	DFG project “Time-multiplexed integrated optical pure single photon source”
2012 - 2017	Project A7 (project area A – periodic structures) “Entangled photon-pairs for applications in quantum communications” in the framework of DFG funded Research training group 1464 „Micro- and Nanostructures in Optoelectronics and Photonics”
2010 - 2013	BMBF project, QUOREP: “Quantum Repeater” – subproject “Interconversion of multi-photon states between telecommunication and visible wavelengths
2010 - 2013	Partner of EU-Project, FP7, Q-ESSENCE: Quantum Interference, Sensors and Communication using Entanglement
2009 - 2011	Partner in G.I.F project (German-Israel Foundation): Quantum Random Walk
2010 - 2013	Partner of EU-Project, FP 7, CORNER: Correlated Noise Effects in Quantum Information Processing
2005 - 2008	Partner in EU-Project, FP 6, QAP: Qubit Applications
2005 - 2011	Max Planck Junior Research Group
2005	Emmy Noether grant of German Research Foundation (declined in favour of Max Planck Junior Research Group)

Honours and Awarded Memberships

since 2023	Member of acatech – National Academy of Science and Engineering
since 2020	Member of the North Rhine-Westphalian Academy of Sciences, Humanities and the Arts, Germany
2017	ERC Consolidator Grant
2015	Silver medal for outstanding international collaboration, Czech Technical University Prague
since 2012	Member of the German National Academy of Sciences Leopoldina
2011	Gottfried Wilhelm Leibniz Prize of the German Research Foundation (DFG)
2008	Heinz Maier-Leibnitz Prize of the German Research Foundation (DFG)
2007	Medal of the Werner-von-Siemens-Ring Foundation for outstanding young scientists
2007	Hertha Sponer Prize for outstanding female scientists of the German Physical Society (DPG)
2006 - 2011	Member of Die Junge Akademie, Germany

Research Priorities

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Many technical developments would not be possible without quantum optics. Quantum mechanical effects play an important role in navigation systems, lasers, the internet and mobile phone networks. Quantum optics studies the fundamentals of light, its properties and the interaction between electromagnetic radiation and matter. Light exhibits both wave and particle properties. Christine Silberhorn studies such quantum properties of light through the use of waveguides. Together with her research group she conducted the world's first experimental demonstration of entangled states (quantum correlations) in the wave property of light and the simultaneous existence of wave- and particle nature of nonclassical correlations (Einstein-Podolsky-Rosen states). A key property of entangled states is that changes to one particle necessarily have an effect on the other. Insights from quantum optics flow directly to developments in quantum technology.

Together with collaborating researchers, Christine Silberhorn also develops detectors that can count the number of photons contained in a pulse of light. In turn, information can be encoded in the light quanta, which thus can be used as information carriers. Quantum information enables secure and efficient information transfer between computers. Photons cannot be copied; as soon as the data has been read by one computer, the original “message” encoded onto the photons is destroyed. The transfer of information by sending single photons through the air or optical fibres (quantum communication) presents a new horizon in the security of information transfer.

To further her research, Christine Silberhorn and her group develop optical components (quantum devices) for single photons and photon pairs. These are the basis for most experiments in quantum optics. An important example is “quantum walks” which can be used to describe energy transport phenomena in biological systems as well as bringing understanding of the transport properties of quantum systems. For her work Silberhorn was awarded the Leibniz Prize of the DFG in 2011, the youngest scientist to receive such an award.