Andreas Heinrich

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EDUCATION

University of Göttingen	Ph.D	Physics	**1998**
University of Göttingen	Masters	(Diplom)	**1994**

PROFESSIONAL ACTIVITIES

- Director of Center for Quantum Nanoscience (QNS) of Institute of Basic Science (IBS), Korea, 2017-current
- Distinguished Professor at Ewha Womans University, Korea, 2016-current
- Research Staff Member at IBM Almaden, United States, 2005-2016
- Researcher / Engineer at IBM Almaden, United States, 2001-2004
- Postdoc at IBM Almaden with Dr. Donald M. Eigler, United States, 1998-2001
- Research Assistant, University of Göttingen (Prof. Rainer G. Ulbrich and Dr. Martin Wenderoth, Supervisors), Germany, 1994-1998

AWARD AND HONORS

- 100 Excellent National R&D Performance in 2018 and Ministerial Citation from the Ministry of Science and ICT, Korea, 2018
- Foresight Institute 2018 Feynman Prize – Experimental, 2018
- Keithley Award for Advances in Measurement Science from the American Physical Society, 2018

MAIN SCIENTIFIC PUBLICATION

- Taeyoung Choi, William Paul, Steffen Rolf-Pissarczyk, Andrew J. Macdonald, Fabian D. Natterer, Kai Yang, Philip Willke, Christopher P. Lutz & Andreas J. Heinrich, Atomic-scale sensing of the magnetic dipolar field from single atoms, *Nature Nanotechnology* volume 12, pages 420–424 (2017)
- Fabian D Natterer, Kai Yang, William Paul, Philip Willke, Taeyoung Choi, Thomas Greber, Andreas J Heinrich, Christopher P Lutz, Reading and writing single-atom magnets, *Nature* 543 (7644), 226 (2017)
- Kai Yang, Yujeong Bae, William Paul, Fabian D Natterer, Philip Willke, Jose L Lado, Alejandro Ferrón, Taeyoung Choi, Joaquín Fernández-Rossier, Andreas J Heinrich, Christopher P Lutz, Engineering the Eigenstates of Coupled Spin- Atoms on a Surface, *Physical review letters* 119 (22), 227206 (2017)

- Philip Willke, Yujeong Bae, Kai Yang, Jose L. Lado, Alejandro Ferrón, Taeyoung Choi, Arzhang Ardavan, Joaquín Fernández-Rossier, Andreas J. Heinrich, Christopher P. Lutz, Hyperfine interaction of individual atoms on a surface, *Science* 362, 336-339 (2018)

RESEARCH INTERESTS

- ***Spin excitation spectroscopy*:** In 2004, Heinrich created the field of atomic scale spectroscopy of individual magnetic atoms on surfaces and helped to grow this topic to international prominence in the following years.

  Key milestones:
  - Design and construction of a novel scanning tunneling microscope for temperatures below 1 Kelvin and high magnetic fields – specifically built to investigate single-atom electron loss spectroscopy on magnetic atoms. This microscope was the first of its kind in the world.
  - First to achieve single atom spin-excitation spectroscopy with his STM measurement of the Zeeman splitting of individual atoms on surfaces (Science 2004).
  - Groundbreaking achievements with spin excitation spectroscopy include the measurement of single atom magnetic anisotropy (Science 2007), spin-spin coupling in engineered chains (Science 2006), and the Kondo effect (Nature Physics 2008).
  - Developed nanosecond scanning tunneling microscopy (STM) (Science 2010), an improvement in time resolution of 100,000 times.
  - Demonstrated atomic-scale magnetic data storage (Science 2012 and Nature 2017), which led to world-wide coverage in scientific and general media.
  - Developed single-atom electron spin resonance in STM (Science 2015) which can be used as quantum sensor on clean surfaces to measure neighboring atoms and molecules (Nature Nanotechnology 2017).
  - Combined spin excitation spectroscopy with ensemble averaging x-ray absorption spectroscopy (Science 2014).
  - Heinrich has given 10 plenary lecture and over 65 invited talks at major international conferences. He has given about 100 seminar and colloquium talks at universities and international research institutions.

- ***Precise atom manipulation*:** In addition to these groundbreaking accomplishments, Heinrich has built on the pioneering achievements of Dr. D.M. Eigler in the area of precise atom manipulation on surfaces by constructing model devices for possible future applications in data storage and computation.

  Key milestones:
  - Development of a technique to control the motion of CO molecules on surfaces. Application of such processes to perform arbitrary logic operations via mechanical computations (Science 2002).
  - Construction of a state-of-the-art low-temperature atomic force microscope in close collaboration with Professor Franz Giessibl (Regensburg) with atomic resolution. This work sparked an increasing interest in low-temperature AFM with atoms and small molecules in the following decade.
  - Published a fundamentally new technique for measuring the atomic forces that act on atoms and molecules on surfaces. Applied this technique to measure the force it takes to move atoms and molecules on surfaces (Science 2008).
  - Construction of complex nanostructures for atomic-scale magnetic data storage (see above, Science 2012).
  - Creation of the World's smallest movie 'A Boy and His Atom' with about 10,000 precise atom moves (YouTube 2013).