Svenja Akkira Knappe

Education

2001: PH.D. in Natural Sciences (Physics) - Rheinische Friedrich-Wilhelms-Universität, Bonn, Germany
Dissertation: " Dark Resonance Clocks and Magnetometers"
Second Subject: Nuclear Medicine
Advisor: Robert Wynands

2000: Correspondence Degree in Medical Physics - University of Kaiserslautern, Germany

1998: Diploma in Physics - Rheinische Friedrich-Wilhelms-Universität, Bonn, Germany
Diploma Thesis: "Polarization-Sensitive Photon-Correlations of Single Cs Atoms in a MOT"
Advisor: Dieter Meschede

Professional Experience

UNIVERSITY OF COLORADO
DEPARTMENT OF MECHANICAL ENGINEERING — 2017 - PRESENT
BOULDER, CO USA
Associate Research Professor

FIELDLINE INC. — 2017 - PRESENT
BOULDER, CO USA
Co-Founder
Commercialization of systems based on microfabricated atomic devices, e.g., optically-pumped magnetometers.

QUSPIN INC. — 2016 - 2017
LOUISVILLE, CO USA
Senior Scientist
Commercialization of small atomic devices, e.g., optically-pumped magnetometers.

UNIVERSITY OF COLORADO
DEPARTMENT OF PSYCHOLOGY AND NEUROSCIENCE — 2013 - PRESENT
BOULDER, CO USA
Associate Professor Adjunct
Research on microfabricated atomic devices, e.g., optically-pumped magnetometers

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) — 2003 - PRESENT
BOULDER, CO USA
Project Leader

Projects

2004 - 2016 — Chip-Scale Atomic Magnetometry

- Investigate fundamental limits to optical magnetometry in millimeter-size vapor cells
- Developed portable magnetometer prototype systems and measured biomagnetic signals of the human heart, muscles, nerves, and brain at the Physikalisch-Technische Bundesanstalt (PTB) Berlin, Germany
- Nuclear Magnetic Resonance (NMR) system, remotely detected with micro-magnetometer in collaboration with University of California at Berkeley

- Develop new MEMS fabrication methods to improve chip-scale atomic magnetometers
- Develop wafer-level fabrication of chip-scale atomic magnetometer sensor heads in collaboration with Charles E. Draper Labs
- Small low-cost magnetometers for magnetic anomaly detection in collaboration with Geometrics Inc.
- Development of a 32-channel magnetoencephalography (MEG) imaging system
- Chip-sale atomic magnetometers for space in collaboration with Applied Physics Lab/John's Hopkins University
- Scientific consulting for National Semiconductor/Texas Instruments on cell fabrication for chip-scale atomic magnetometers

2004 - 2007 — Chip-Scale Atomic Clocks

- Microfabricated vapor cells for chip-scale atomic sensors: develop methods to create high vacuum in small microfabricated structures
- Advanced interrogation schemes for chip-scale atomic clocks based on coherent population trapping
- Low-power microwave oscillator and miniature control electronics for chip-scale atomic clocks
- Developed improved microfabricated vapor cell technology amenable to wafer-level fabrication
- Anti-relaxation wallcoatings in alkali vapor cells
- Self-assembled monolayers as surface coatings for alkali cells in collaboration with CU Boulder and Princeton University
- Diode laser technology and noise characteristics
- Electronic and optical feedback systems
- Scientific consulting for Honeywell Inc.

2004 – present — Other Chip-Scale Atomic Devices

- Parallel wafer-level cell fabrication for chip-scale atomic devices
- Demonstrated first microfabricated laser frequency stabilization
- Microfabricated vapor cells for small lightweight laser frequency stabilization in collaboration with AOSense Inc.
- Miniature Dichroic Atomic Vapor Laser Lock in collaboration with the University of California at Berkeley
- Advanced vapor cells for NMR gyroscopes in collaboration with UC Davis
- Miniature atomic optical isolator in collaboration with University of Durham, UK
- Micrometer-size atomic vapor cells for low-power atomic sensors

NIST Affiliations through

Employee	2012 – 2016
University of Colorado at Boulder, CO USA	2009 – 2012
Protiro Inc., Denver, CO USA	2005 – 2009
University of Colorado at Boulder, CO USA	2005
Rheinische Friedrich Wilhelms Universität, Bonn, Germany	2004 – 2005

SELF-EMPLOYED SCIENTIFIC CONSULTANT — 2010 - 2011
BOULDER, CO USA

Twinleaf LLC: Low-Cost chip-scale atomic magnetometer design and cell fabrication (part-time)

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) — 2001 - 2003
BOULDER, CO USA

Postdoctoral Guest Researcher

- Developed the first chip-scale atomic clock physics package
- Developed the first microfabricated alkali vapor cells
- Determined sensitivity limits for coherent population trapping in small vapor cells

RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITÄT— 2001
BONN, GERMANY
Postdoctoral Guest Researcher

- Locked the repetition rate of a femtosecond laser to a miniature microwave Rb Clock

RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITÄT— 1998 - 2001
BONN, GERMANY
Graduate Research and Teaching Assistant

- Dark Resonance clocks and magnetometers

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) — 1999 - 2000
BOULDER, CO USA
Graduate Student Guest Researcher

- CPT atomic clocks

RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITÄT— 1997 - 1998
BONN, GERMANY
Diploma Research Assistant

- Single Cs atoms in a magneto-optical trap

PAUL SCHERRER INSTITUTE — 1996
VILLIGEN, SWITZERLAND
Trainee

- Monte Carlo simulations of positron paths in materials with high scattering rates for positron-emission tomography

UNIVERSITY OF NEW SOUTH WALES — 1995
SYDNEY, AUSTRALIA
Undergraduate Research Assistant

- *Honors Project:* Monte Carlo Calculation of Mass Gap
- Quantum Chromodynamics

Additional Information

HONORS AND SCHOLARSHIPS

- **2016 James Zimmerman Prize** of the IFMBE
- **2014 Department of Commerce Gold Metal** "for their leadership of the NIST chip-scale atomic device program, which includes pioneering the first chip-scale atomic clocks, magnetometers, gyros, and other precision atom-based devices"
- **Rank Prize 2014** in Optoelectronics "for the creation and demonstration of the first chip-scale atomic clock", Rank Foundation (London, England)
- **2013 Colorado Governor's Award** for High-Impact Research for "Foundational Technology"
- "**100 Frauen von morgen**" - "100 women of the future", awarded by the initiative "Deutschland - Land der Ideen" of the German federal government and the German Industry (BDI), 2012
- German Scholar Organization (GSO), Building Bridges - Spitzenforscher für Deutschland, Spitzenforschung in Deutschland, Stipend 21.- 25. June 2011
- European Frequency and Time Forum (EFTF), **Young Scientist Award** 2007
- NIST Physics Laboratory and Time and Frequency Division, Honoring leadership and achievements as crucial member of the Chip-Scale Atomic Clock team recognized with the 2005 **US Department of Commerce Silver Medal**
- NIST, Boulder Postdoctoral Poster Symposium finalist 2004
- IEEE appreciation, presents Innovation and Technology in Colorado 2003
- DAAD (German Exchange Service), Scholarship 1999
- DAAD (German Exchange Service), Scholarship 1995

PERSONAL DEVELOPMENT

- NIST Future Leadership Program, 1 year, 2014-2015, Department of Commerce
- "Supervisory Leadership Seminar", 1 week, 2009, Office of Personnel Management
- "DoC Mentoring program", 1 year, 2008, Department of Commerce
- "Crew leader training", 2 days, 2007, Wildland Restoration Volunteers

MEMBERSHIPS AND COMMITTEES

- Annual meeting on optically-pumped magnetometers, organizer, 2014-present
- Awards Committee for Biomag conference, 2018
- Technical Program Committee for European Frequency and Time Forum, 2011-2017; vice-chair for 2015 - 2017
- Technical Program Committee IEEE Frequency Control Symposium, 2011-2017; vice-chair for 2014 - 2017
- Deutsche Physikalische Gesellschaft
- Optical Society of America
- European Physical Society

RECENT ORAL PRESENTATIONS

- Innovation Symposium on Optically Pumped Magnetometers, 2018, ***invited***, "Microfabricated Optically Pumped Magnetometers for non-invasive Brain Imaging"
- Kolloquium des Institutes für Microsystemtechnik der Universität Freiburg, 2018, ***invited***, "Magnetic Imaging with Microfabricated Optically Pumped Magnetometers"
- International Workshop on Advanced Magnetometry for Defense Applications, 2018, ***invited***, "Microfabricated optically-pumped magnetometers for imaging applications"
- South African Institute of Physics, 2017, ***plenary speaker***,"From atoms to brains: Microfabricated atomic sensors for non-invasive magnetic brain imaging"

- IQST Tag Ulm, 2017, ***invited***, "From atoms to brains: Imaging arrays with optically-pumped magnetometers",
- International Conference on Biomagnetism, 2016, "Microfabricated OPMs for an MEG prototype array"
- Quantum UK conference, 2016, ***invited***,"Microfabricated optically-pumped magnetometer arrays for biomedical applications"
- Physics Colloquium University of Colorado Boulder, 2016, ***invited***, "From atoms to brains: Microfabricated atomic sensors for non-invasive magnetic brain imaging?"
- Frequency Standards and Metrology Conference in Potsdam, Germany, 2015, ***invited***, "Optically-Pumped Magnetometers for Biomedical Applications"
- Workshop on Optically-Pumped Magnetometers in Helsinki, Finland, 2015, ***invited***, "Magnetoencephalograpy and fetal magnetocariography shocases using microOPMs"
- University College London, UK, 2015, ***invited***,"Microfabricated optically-pumped magnetometers for MEG"
- University of Nottingham, UK, 2015, ***invited***,"Microfabricated optically-pumped magnetometers"
- NSF workshop on next-generation non-invasive brain imaging, Washington DC, 2015, ***invited***, "Microfabricated atomic magnetometers for next-generation brain imaging?"
- RWTH Aachen, Germany, 2014, ***invited***,"Chip-Scale Atomic Clocks and Magnetometers"
- CLEO Conference, Enabling Photonics Technologies for Miniaturization, 2014, ***invited***, "Microfabricated Optically-Pumped Magnetometers"
- University of Colorado Colorado Springs, 2014, ***invited***, "Chip-scale atomic magnetometers for biomagnetic imaging"
- BIOMAG Conference in Halifax CA, 2014, ***invited***, "Microfabricated Optically-Pumped Magnetometers for MEG"
- Workshop on Atomic Magnetometers in Halifax, CA, 2014, ***invited***, Microfabricated Optically-Pumped Magnetometers for biomedical measurements"
- Universität Stuttgart/Germany, SFB/TRR21 Kolloquium, 1013, ***invited***, "Microfabricated optically-pumped magnetometers"
- Workshop on Atomic Magnetometers in Seattle, WA, 2013, ***invited***, "Chip-Scale Atomic Magnetometers for MEG"
- 5th Autumn School "Structure the Brain"in Tübingen/Germany, 2012, ***invited***, "Chip-Scale Atomic Magnetometers for MEG"
- BIOMAG Conference, 2012, ***invited***,"Chip-Scale Atomic Magnetometers for Biomagnetic Imaging"
- Christian-Albrechts-Universität zu Kiel/Germany, SFB 855 Kolloquium, 2012, ***invited***, "Chip-scale atomic magnetometers for Biomagnetic Measurements"
- 5th European Conference of the International Federation of Medical and Biological Engineering, 2011, "Chip-Scale Room-Temperature Atomic Magnetometers for Biomedical Measurements"
- Institute of Photonic Technology (IPHT) Jena, 2010, ***invited***, "Chip-scale atomic magnetometers at NIST"
- University of California at Berkeley, 2010, ***invited***, "Microfabrication Technologies for Chip-Scale Atomic Devices"
- Meeting of the Division of Atomic Molecular and Optical Physics of the American Physical Society, 2010, ***invited***,"Chip-Scale Atomic Magnetometers"
- European Frequency and Time Forum, 2010, ***invited***, "Advances in Chip-Scale Atomic Magnetometers"
- International Conference on Applied Atom Optics, 2009, ***invited***, "Atomic Microclocks and Magnetometers"
- European Frequency and Time Forum jointly with International Frequency Control Symposium, 2009, "A photonic magnetometer"
- Institute of Navigation, Southern California Chapter, 2008, ***invited***, "Chip-Scale Atomic Clocks"
- European Frequency and Time Forum jointly with International Frequency Control Symposium, 2007, "Generation of CPT Resonances with nearly 100% Transmission Contrast"
- SPIE Optics and Photonics, 2007, ***invited***,"Advances in Chip-Scale Atomic Frequency References at NIST"

- SPIE Photonics West, 2007, "Long-Term Stability of NIST Chip-Scale Atomic Clock Physics Packages"
- Japanese workshop on chip-scale atomic clocks, 2006, ***invited***, "Microfabricated vapor cells for chip-scale atomic devices"
- International Conference on Quantum Electronics, 2006, ***invited***, "Chip-Scale Atomic Devices at NIST"
- Precision Time and Time Interval Meeting, 2006, "Long-Term Stability of NIST Chip-Scale Atomic Clock Physics Packages"
- Colorado Technology Workshop, 2005, ***invited***, "An atomic clock on a chip"
- International Conference on Laser Spectroscopy, 2005, ***invited***, "Chip-Scale Atomic Clocks and Magnetometers"
- LEOS Optical MEMS Conference, 2005, "Microfabricated Atomic Clocks and Magnetometers"
- Frequency Control Symposium, 2004, ***invited***, "Microfabricated atomic frequency references"
- Institute of Navigation, 2004, "Chip-Scale vapor-cell atomic clock"
- Precision Time and Time Interval Meeting, 2004, "Microfabricated Atomic Clocks at NIST"
- Frequency Control Symposium, 2003, "Atomic vapor cells for miniature frequency references"

RECENT LECTURES AND TUTORIALS

- Summer school on Quantum Materials and Quantum Technology, 2018, "Quantum Sensors, from proof-of-concept to the market"
- International conference on Biomagnetism, 2016, satellite meeting on "Optically-pumped magnetometers for biomedical applications"
- International Frequency Control Symposium, tutorial, 2016, "Atomic Sensors"
- NIST Metrology Seminar, lecture, 2016, "Chip-Scale Atomic Sensors and Clocks"
- CU Mechanical Engineering course - Fall Semester 2015: "Statics and Structures"
- NIST Metrology Seminar, lecture, 2015, "Chip-Scale Atomic Sensors and Clocks"
- NIST Metrology Seminar, lecture, 2014, "Chip-Scale Atomic Sensors and Clocks"
- NIST Metrology Seminar, lecture, 2013, "Chip-Scale Atomic Sensors and Clocks"
- USNO and United Kingdom Hydrographic office, Navigation and Timing 1730-2030: From Greenwich to Space Symposium, lecture, 2013, "Chip-Scale Atomic Sensors and Clocks"
- International Scientific CNRS School on"High Sensitivity Magnetometers, lecture, 2012, "Chip-Scale Atomic Magnetometers"
- NIST Metrology Seminar, lecture, 2012, "Chip-Scale Atomic Sensors and Clocks"
- Workshop on Synchronization in Telecommunication Systems, 2009, tutorial, "Chip-Scale Atomic Clocks"
- International Frequency Control Symposium, IEEE, 2008, tutorial, "Chip-Scale Atomic Magnetometers"
- NIST Metrology Seminar, lecture, 2006, "Chip-Scale Microfabricated Atomic clock"
- Workshop on Synchronization in Telecommunication Systems, 2005, tutorial, "Chip-Scale Atomic Clocks at NIST"

LANGUAGES

Fluent in English and German • Basic Skills in French and Spanish • Latinum in Latin

TECHNICAL REVIEWER

Physical Review Letters • Physical Review A • Journal of Physics B • Optics Letters • IEEE Transactions • ASME • The Journal of Physical Chemistry • Applied Physics B • Sensors and Actuators A • Journal of the Optical Society of America B • Journal of Electronic Packaging • Chinese Physics Letters • Journal of Applied Physics • Review of Scientific Instruments• Symmetry• Journal of Vacuum Science and Technology • National Science Foundation (NSF) • Office of Naval Research (ONR) • National Institute of Health (NIH)