

Sebastian Will

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Employment

- since 07/2016 **Assistant Professor, Columbia University**
Ultracold atoms and molecules • quantum simulation • quantum information • dipolar many-body quantum systems • programmable atomic tweezer arrays
- 07/2016 – 02/2018 **Visiting Professor, Massachusetts Institute of Technology**
- 11/2015 – 06/2016 **Research Scientist, Massachusetts Institute of Technology**,
group of Martin Zwierlein, quantum systems of ultracold molecules
Quantum control of ultracold molecules • qubit storage in molecular nuclear spin • ultracold molecule-molecule collisions
- 12/2011 – 10/2015 **Postdoctoral Research Fellow, Massachusetts Institute of Technology**,
group of Martin Zwierlein, first creation of ultracold dipolar NaK molecules
Ultracold dipolar molecules of NaK in the absolute ground state • high-finesse optical cavities • precision molecule spectroscopy

Education

- 11/2011 **Graduation (Dr. rer. nat.), University of Mainz**,
“Interacting bosons and fermions in three-dimensional optical lattice potentials”,
grade: summa cum laude (highest grade)
Ultracold quantum gases • quantum simulation • Hubbard model • nonequilibrium quantum dynamics • beyond Hubbard model physics
- 11/2006 – 11/2011 **Graduate Studies, University of Mainz & Ludwig Maximilian University Munich**, group of Immanuel Bloch
- 11/2006 **Diplom, University of Mainz**, “Atom optical experiments with ultracold sodium atoms”, grade: with distinction (highest grade)
- 03/2005 – 08/2006 **Undergraduate Thesis Research, Massachusetts Institute of Technology**,
group of Wolfgang Ketterle
- 10/2001 – 09/2006 **Undergraduate Studies in Physics, University of Mainz**

Honors and Awards

- 03/2019 **NSF CAREER Award 2019**
- 01/2018 **Lenfest Junior Faculty Development Grant**
- 02/2017 **Alfred P. Sloan Research Fellowship**
- 04/2014 **Infinite Kilometer Award of the MIT School of Science**
- 04/2012 **Springer Theses Award**
- 04/2007 – 08/2011 **Junior Fellow of the Gutenberg Academy at University of Mainz**
- 02/2002 – 11/2006 **Fellow of Studienstiftung des deutschen Volkes**

Selected Publications

19 publications in refereed journals, **4 in Nature/Science**, **9 in PRL/Nature Physics** Google Scholar: **h-index 18**, **number of citations >3200**, average citations per article >160

- 6** Zoe Z. Yan, Jee Woo Park, Yiqi Ni, Huanqian Loh, **Sebastian Will**, Tijs Karman, and Martin Zwierlein, *Resonant dipolar collisions of ultracold molecules induced by microwave dressing* arXiv:2003.02830 (2020) (submitted to Phys. Rev. Lett.)
- 5** Jee Woo Park, Zoe Z. Yan, Huanqian Loh, **Sebastian Will**, and Martin Zwierlein, *Second-Scale Nuclear Spin Coherence Time of Trapped Ultracold $^{23}\text{Na}^{40}\text{K}$ Molecules* Science **357**, 372-375 (2017)
- 4** **Sebastian Will**, Jee Woo Park, Zoe Z. Yan, Huanqian Loh, and Martin Zwierlein, *Coherent Microwave Control of Ultracold $^{23}\text{Na}^{40}\text{K}$ Molecules* Phys. Rev. Lett. **116**, 225306 (2016)
Editors' Suggestion, featured in Physics
- 3** Jee Woo Park, **Sebastian Will**, and Martin Zwierlein, *Ultracold Dipolar Gas of Fermionic $^{23}\text{Na}^{40}\text{K}$ Molecules in Their Absolute Ground State* Phys. Rev. Lett. **114**, 205302 (2016)
Editors' Suggestion, featured in Physics, printed 16 days after submission – one of the fastest papers in the history of Physical Review Letters
- 2** **Sebastian Will**,
From Atom Optics to Quantum Simulation - Interacting Bosons and Fermions in 3D Dimensional Optical Lattice Potentials
Springer Theses, Springer, Heidelberg, ISBN 978-3-642-33632 (2013)
>9000 downloads since January 2013 (www.bookmetrix.com)
- 1** **Sebastian Will**, Thorsten Best, Ulrich Schneider, Lucia Hackermüller, Dirk-Sören Lühmann, and Immanuel Bloch,
Time-Resolved Observation of Coherent Multi-Body Interactions in Quantum Phase Revivals Nature **465**, 197-201 (2010)

Collaborators

Francis Alexander, BNL • Ehud Altman, UC Berkeley • Ana Asenjo-Garcia, Columbia • Immanuel Bloch, MPQ/LMU Munich • Gabriele Ferrari, Trento • Bryce Gadway, UIUC • Alex Gaeta, Columbia • Layla Hormozi, BNL • Wolfgang Ketterle, MIT • Michal Lipson, Columbia • Huanqian Loh, NUS • Marco Loncar, Harvard • Jee Woo Park, POSTECH • David Pritchard, MIT • Marcos Rigol, Penn State • Daniel Savin, Columbia • Javad Shabani, NYU • Nanfang Yu, Columbia • Martin Zwierlein, MIT

Teaching and Advising

- **Instructor**, *Advanced Physics Lab* (S2020), UN3081 Columbia University
- **Instructor**, *Classical and Quantum Waves* (F2019), UN2601 Columbia University
- **Instructor**, *Seminar in Current Research Problems* (S2018), UN3072 Columbia University
- **Instructor**, *Applied Quantum Mechanics* (S2017, F2017, S2019), GU4024 Columbia University
- **Instructor**, *Graduate Student Seminar* (F2016 - S2018, F2019), GR6905 Columbia University
- **Faculty Supervisor** of (3) PhD and (14) undergraduate students (since 2017)
- **Postdoctoral Supervisor** of (9) PhD and (5) undergraduate students (2012 – 2016)
- **Recitation Leader**, *Statistical Mechanics* (S2014), Physics 8.044, MIT
- **Teaching Assistant**, *Atomic Physics* (F2006, F2008), *Photonics* (S2008)

Other activities

- **Chair, New York Joint Quantum Symposium**, annual workshop on quantum science and technology in collaboration with Columbia, NYU, Flatiron Institute (2018, 2019, 2020)
- **Co-Chair, QClub**, seminar series in collaboration with Columbia, NYU, and Flatiron Institute
- **Co-Organizer, Columbia CM-AMO Seminar**, bi-weekly seminar series (2019/20)
- **Co-Organizer, Low Energy Challenges for High Energy Physics** (PI Waterloo, CA) (2018)
- **Referee** for *Nature*, *Science*, *Nature Physics*, *Physical Review Letters*, and others
- **Reviewer** for *National Science Foundation (NSF)*, *European Research Council (ERC)*, *Austrian Science Fund (FWF)*
- **Outreach, High School Teacher education**, workshop program in collaboration with STEMteachersNYC to educate high school teachers in quantum science (from Fall 2020)
- **Physics Department Colloquium Committee**, Columbia University (2016, 2017, 2018)
- **Graduate Admissions Committee**, Columbia University (2017, 2020)
- **PhD Thesis Defense Committee**, Columbia University (11 defenses since 2016)
- **Faculty Search Committee**, Columbia University (2017-AMO, 2018-AMO, 2019-CM, 2020-AMO)

Main Scientific Achievements

- First realization of microwave dressing of ultracold dipolar molecules (Publication **19**)
- Observation of resonant dipole-dipole interactions of ultracold dipolar molecules (Publication **19**)
- Realization of a qubit in the nuclear spin of ultracold NaK molecules. Observation of second-scale coherence times (Publication **18**)
- Full quantum state control of ultracold NaK molecules (Publication **17**)
- First creation of ultracold, chemically stable, dipolar molecules of NaK in the rovibrational ground state (Publications **15** and **16**)
- Direct observation of coherent quench dynamics in a metallic many-body state of fermionic atoms (Publications **13** and **14**)
- Observation of Feshbach resonances in a quantum gas mixture of bosonic Na and fermionic K atoms. Creation of weakly bound NaK Feshbach molecules (Publications **11** and **12**)
- Observation of effective three-body interactions via long-lived collapse and revival dynamics of a lattice superfluid. Direct demonstration of physics beyond the Hubbard model in optical lattices (Publications **7** and **10**)
- Concept of quantum revival spectroscopy for the precision measurement of atomic interactions (Publication **7**)
- Equilibrium phases and nonequilibrium expansion dynamics of interacting lattice quantum gases of fermionic atoms (Publications **6** and **8**)
- Observation of renormalized interactions beyond the Hubbard model in strongly interacting atomic Fermi-Bose mixtures in an optical lattice (Publication **4**)
- Realization of the Fermi-Hubbard model with fermionic atoms in an optical lattice. Observation of metallic, band and Mott insulating phases by measuring the compressibility (Publication **3**)
- First loading of ultracold atoms into a hollow-core photonic bandgap fiber (Publication **2**)
- Observation of number squeezing and long coherence time in an atom interferometer with Bose-Einstein condensates on an atom chip (Publication **1**)

(**numbers** refer to the publication list)