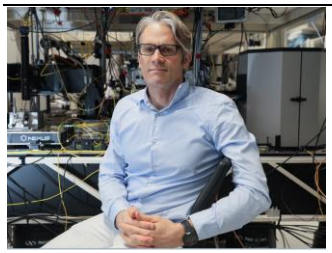
CONTACT INFORMATION



EPFL - Ecole Polytechnique Fédérale de Lausanne
"Laboratory of Photonics and Quantum Measurements"
SB-LPQM, Station 3, CH-Lausanne, Switzerland
Citizenship: Germany
Date of birth: 8th Nov. 1976

Email: tobias.kippenberg@epfl.ch ;
Internet: k-lab.epfl.ch

EDUCATION

Habilitation in Experimental Physics, **Ludwig-Maximilians-Universität München** (LMU)	2009
Ph.D. in Applied Physics**, California Institute of Technology (Caltech)**	2004
M.S. in Applied Physics, **California Institute of Technology (Caltech)**	2000
B.A. in Physics **and** Electrical Engineering, **Technical University of Aachen** (RWTH)	1998

PROFESSIONAL AND ACADEMIC EXPERIENCE

Ecole Polytechnique Fédérale de Lausanne (EPFL)

- Full Professor of Physics and Electrical Engineering — 2013 - Present
- Associate Professor of Physics and Electrical Engineering — 2010 - 2012
- Tenure Track Assistant Professor of Physics and Electrical Engineering — 2008 - 2010

Max Planck Institute of Quantum Optics, Garching, Germany

- Full time Leader of an Independent Max Planck Junior Research Group — 2005 - 2008

California Institute of Technology, Pasadena, USA

- Graduate Research Assistant and Postdoctoral Scholar (K.J. Vahala group) — 2000 - 2005

PRIZES

- **ZEISS Research Award** — 2018
- **Klung Wilhelmy Wissenschafts Preis** — 2015
- **Swiss National Latsis Award** (for research in "Cavity Quantum Optomechanics" — 2014
- **International ICO Award** — 2013
- **EFTF Young Scientist Award** (for invention of the "monolithic frequency comb"**)** — 2011
- **Fresnel Prize of the European Physical Society** — 2009
- **Helmholtz Prize for Metrology** (for invention of the "monolithic frequency comb") — 2009
- **1st Prize 8th European Union Contest for Young Scientist** — 1996
- **Jugend forscht Bundessieger Physik** — 1996

FELLOWSHIPS & DISTINCTIONS

Optical Society of America Fellow	2017
American Physical Society Fellow	2016
Thomson Reuters ISI Highly cited in Physics (top 1% in Physics)	2014 - 2017
ERC Advanced Grant	2012
ERC Starting Grant	2007
Marie Curie Excellence Grant	2006
Studienstiftung der Deutschen Volkes	1998 - 2002

RESEARCH INTERESTS

The Physics and Applications of ultra-high Q optical microresonators, in particular for *optical frequency comb generation* and *cavity quantum optomechanics*.

OFTEN QUOTED PUBLICATION METRICS

- **Clarivate Analytics http://www.highlycited.com/ in Physics (1% top cited) –** 2014-2018
- Total number of citations to date: WoK > 18,000 (GoS: >29,000) – 4600 cited/year
- Hirsch-Index (N papers cited N times): WoK: 58 (GoS: 70)
- Journals : **Nature 9, Science 7, Nature subjournals 24** (Photonics **8**, Comm **7**, Physics **6**, Nanotech **3**), **PRL 18**

INVITED TALKS

More than **246 invited talks** (10 plenary talks). A list can be found on my group website at https://k-lab.epfl.ch/files/content/sites/klab/files/TJK_list_of_talks/Kippenberg_ListTalks_July_2018.pdf

SELECTED LIST OF CONTRIBUTIONS TO SCIENCE AND DISCOVERIES

- Discovery of ultra-high Q optical microresonators on a chip[1] – **Nature (2003)** [**This paper has been influential in defining and creating the field of ultra-high Q microresonators. Cited >1800 times in GoS to date**]
- Discovery of radiation pressure dynamical backaction amplification in a microresonator[1] – *Phys. Rev. Lett.* (2005) [**First demonstration of radiation pressure backaction on a mechanical oscillator predicted by Braginsky in 1969. It lays the groundwork to the field of cavity optomechanics with micro-scale devices, a field producing more than 2000 papers since then]**
- First demonstration of radiation pressure cooling of a mechanical oscillator (simultaneously with A. Heidmann and A. Zeilinger) – Phys. Rev. Lett. (2006)
- Discovery of microresonator based optical frequency combs – *Nature* (2006) [**Created new research field at intersection of frequency metrology, nonlinear photonics, and microresonator Physics producing >1000 papers to date**]
- First quantum theory of radiation pressure cooling (jointly with Wilhelm Zwerger, simultaneous to S. Girvin and F. Marquardt) – Phys. Rev. Lett. (2007) [**This paper is the first to identify the quantum limit of radiation pressure cooling**]
- First demonstration of resolved sideband cooling of a mechanical oscillator – *Nature Physics* (2008)
- First measurements at the standard quantum limit of mechanical imprecision – *Nature Physics* (2009)
- Demonstration of measurement imprecision below that at the standard quantum limit (simultaneous to K. Lehnert, NIST) – *Phys. Rev. A.* (2010)
- Demonstration of optomechanically induced transparency – *Science* (2011)
- First demonstration of quantum coherent coupling of an optical to a mechanical mode – *Nature* (2012)
- Discovery of temporal dissipative solitons in an optical microresonator – *Nat. Photon*. (2014) [**This research created the field of "micro-combs" a new research field at intersection of frequency metrology, nonlinear photonics, and microresonator Physics producing >2000 papers to date**]
- Demonstration of coherent communication with Kerr combs (with C. Koos[1]) – *Nat. Photon*. (2014)
- First measurement of a mechanical oscillator at the thermal decoherence rate – *Nature* (2015)
- Optomechanical theory of Surface Enhanced Raman Scattering (SERS) – *Nature Nanotech.* (2016)
- Observation of soliton switching in micro-resonators – *Nature Physic*s (2016)
- Observation soliton induced Cherenkov radiation in an optical microresonator – *Science* (2016) [**This paper is the first to demonstrate dissipative solitons on a photonic chip]**
- Demonstration of quantum correlations in feedback cooling – *Phys. Rev. X* (2017)
- Demonstration of a dissipative reservoir for microwaves using circuit optomechanics – *Nature Physics* (2017)
- Terabit communications with photonic chip soliton frequency combs (with C. Koos) – ***Nature*** (2017)
- Quantum feedback cooling and sideband asymmetry of a nanomechanical oscillator – *PRX* (2017)
- Demonstration of room temperature quantum correlations – *PRX* (2017)
- Ultrafast optical ranging with microresonator soliton combs (jointly with C. Koos) – ***Science*** (2018)
- Mid infrared dispersive wave generation in SiN integrated waveguides, ***Nature Photonics***, (2018)
- Highest Q of a room temperature mechanical oscillator using strain engineering - ***Science*** (2018) [**This work constitutes the highest quality factor of any mechanical oscillator measured at room temperature**]
- Spatial multiplexing of dissipative Kerr solitons, ***Nature Photonics***, 2018 in press
- An optical-frequency synthesizer using integrated photonics, ***Nature*** (2018) [**This work was part of a large-scale collaborative effort led by NIST, demonstrating the first integrated photonics "micro-comb" synthesizer**]

[1] This joint publication earned our collaborator C. Koos the "Landesforschungspreis Baden Württemberg 2014"

Section c: Ten-year track record (max. 2 pages)

10 MOST IMPORTANT PUBLICATIONS (AS SENIOR *AND* CORRESPONDING AUTHOR)

- A. H. Ghadimi, S. A. Fedorov, N. J. Engelsen, M. J. Bereyhi, R. Schilling, D. J. Wilson, T. J. Kippenberg
  "Elastic strain engineering for ultralow mechanical dissipation"
  Science (2018) – citations GoS: 7
- P. Marin-Palomo, J. N. Kemal, M. Karpov, A. Kordts, J. Pfeifle, M. H. P. Pfeiffer, P. Trocha, S. Wolf, V. Brasch, M. H. Anderson, R. Rosenberger, K. Vijayan, W. Freude, T. J. Kippenberg, C. Koos
  "Microresonator-based solitons for massively parallel coherent optical communications"
  Nature (2017) – citations GoS: 117
- V. Brasch, M. Geiselmann, T. Herr, G. Lihachev, M. H. P. Pfeiffer, M. L. Gorodetsky, T. J. Kippenberg
  "**Photonic chip-based optical frequency comb using soliton Cherenkov radiation**"
  Science (2015) – citations GoS: 289
- D.J. Wilson, V. Sudhir, N. Piro, R. Schilling, A. Ghadimi, T. J. Kippenberg
  "Measurement-based control of a mechanical oscillator at its thermal decoherence rate"
  Nature (2015) – citations GoS: 136
- T. Herr, V. Brasch, J.D. Jost, C.Y. Wang, N.M. Kondratiev, M.L. Gorodetsky, T.J. Kippenberg
  "Temporal solitons in optical microresonators"
  Nature Photonics (2014) – citations: GoS: 634
- E. Verhagen, S. Deléglise, S. Weis, A. Schliesser and T.J. Kippenberg
  "Quantum-coherent coupling of a mechanical oscillator to an optical cavity mode"
  Nature (2012) – citations GoS: 602
- S. Weis, R. Rivière, S. Deléglise, E. Gavartin, O. Arcizet, A. Schliesser, and T. J. Kippenberg
  "Optomechanically Induced Transparency"
  Science (2010) – citations GoS: 816
- I. Wilson-Rae, N. Nooshi, W. Zwerger, T.J. Kippenberg
  "Theory of ground state cooling of a mechanical oscillator using dynamical back-action"
  Phys. Rev. Lett. 99, 093901 (2007) – citations GoS: 759
- A. Schliesser, R. Riviere, G. Anetsberger, O. Arcizet, T.J. Kippenberg
  "Resolved sideband Cooling of a Mechanical Oscillator"
  Nature Physics 4, 415 (2008) – citations GoS: 557
- P. Del Haye. A. Schliesser, O. Arcizet, T. Wilken, R. Holtzwarth, T.J. Kippenberg
  "Optical frequency comb generation from a monolithic microresonator"
  Nature 450, 1214 (2007) – citations GoS 1279

REVIEW ARTICLES WRITTEN AS PRINCIPAL INVESTIGATOR/CORRESPONDING AUTHOR

1. T. J. Kippenberg, A. L. Gaeta, M. Lipson, M. L. Gorodetsky
   "Dissipative Kerr solitons in optical microresonators"
   Science, 361 6402 (2018)
2. M. Aspelmeyer, T.J. Kippenberg, F. Marquardt
   "Cavity Optomechanics"
   Review of Modern Physics, 86, 1391 (2014) – citations GoS: 2059
3. T.J. Kippenberg and K.J. Vahala
   "Cavity Optomechanics: Back-Action at the Mesoscale"
   Science, Review article 321, 1172 (2008) – citations GoS: 1504
4. T.J. Kippenberg, R. Holzwarth, S.A. Diddams
   "Microresonator based optical frequency combs"
   Science Review article (2011) – citations GoS 2011

ADVANCEMENT OF YOUNG RESEARCHERS

I take a keen interest in advancing the careers of my co-workers as witnessed by their success today (prizes, positions, papers). I carefully guide their research and encourage them to apply for Marie Curie fellowships (12 approved so far). These efforts have contributed to their future success as independent scientist, with 9 *secured positions as group leader or professor* (7 in the field of optomechanics). I also actively scout Prizes

for my co-workers, which have resulted in 3 EPS thesis Prizes of the QUOD, The Latsis Prize, IOP thesis Prize, Otto-Hahn Medal, and Helmholtz Prize.

Academic appointments of co-workers and prizes:

1. Prof. Albert Schliesser, University of Copenhagen, Full Professor (*ERC, EPS thesis Prize, Otto Hahn Medal, Latsis Prize*)
2. Dr. Pascal Del Haye, Group Leader NPL, UK (*EPS thesis Prize, Helmholtz Prize of Metrology*)
3. Dr. Tobias Herr, CSEM research scientist (*IOP thesis award*)
4. Prof. Ewold Verhagen, Group Leader AMOLF, Professor at Eindhoven (*ERC Grantee, Marie Curie IF*)
5. Prof. Pierre Verlot (*ERC Grantee*)
6. Dr. Olivier Arcizet *(ERC Grantee*)
7. Dr. Samuel Deleglise, CR- LKB ENS group leader (*Marie Curie IF)*
8. Prof. Christophe Galland, SNF Professorship at EPFL
9. Dalziel Wilson, Assistant Professor of Optical Sciences, University of Arizona (*Marie Curie IF*)

Industrial appointments of co-workers and technology transfer:

- Dr. Emanuel Gavartin, director of research, Zeiss AG Oberkochen (*EPFL Thesis Prize*)
- Dr. Michael Geiselmann (*Marie Curie CO-FUND)* & Dr. Michael Zervas, co-founders of LiGenTec SA https://www.ligentec.com
- Dr. John Jost, founder of Micro-R Systems http://www.microrsystems.com (*Marie Curie IF)*
- G. Anetsberg Patent Lawyer (Munich), J. Dobrindt (McKinsey Consulting Munich), R. Riviere, Technical Manager (Airbus Munich)

INDUSTRIAL INNOVATION

Research in my laboratory has also brought forward a novel class of optical frequency comb generator based on parametric frequency conversion in optical microresonators using the Kerr nonlinearity. OEWaves has already used some of these developments (for low noise soliton states for microwave generation). With my former co-workers I have founded a start-up on SiN integrated photonic (*LiGenTec SA*).

SERVICE TO THE ACADEMIC COMMUNITY

I have taken an active role in organizing topical meetings around quantum optomechanics and microresonator frequency combs, and been the sole organizer of several (5) *Monte Verità* workshops:

- Organizer of Monte Verità Workshop "Quantum Optics of Micro and Nanomechanical Systems", 2016, 2014, 2011
- Organizer of Monte Verità Workshop "Microresonator based Optical Frequency Combs", 2016
- Organizer of Monte Verità Workshop "Microresonator based Optical Frequency Combs", 2014
- Chair 2012 for the Gordon Conference on "Mechanical Systems at the Quantum Limit"

SCIENTIFIC COORDINATOR OF RESEARCH NETWORKS

I have taken a vested interest in shaping the European cavity quantum optomechanics community by having been ***initiator*** and ***sole coordinator*** of ***three largescale networks***:

- Coordinator of FET-Proactive "Hybrid Optomechanical Technologies" 2016-2020 (€10 mio)
- Coordinator of a Marie Curie Training Network on "Optomechanical Technologies" 2016-2020 (€3.9 mio)
- Coordinator of a Marie Curie Training Network on "Cavity Quantum Optomechanics" 2012-2016 (€5.7 mio)

COLLABORATIONS

- M.L. Gorodetsky MSU (Soliton physics and frequency comb generation in microresonators)
- C. Koos KIT & A. Willner USC (Coherent terabit communications with microresonator frequency combs)
- J. Bowers UCSB (Development of a Chip Scale Optical Frequency Synthesizer, DARPA DODOS)
- A. Nunnenkamp U Cambridge (Theory of quantum optomechanics)

PATENTS

- "Method and apparatus for optical frequency combs generation", EU/US patent application EP0**7009067**
- "Generating optical pulses via a soliton state of an optical microresonator", EP**2962156A1**
- "Waveguide fabrication method", US Patent No. US**15/145,968**
- "Device system for on-chip quantum microwave-to-optical and microwave", US patent No. US62/300,936