PERSONAL INFORMATION

EPFL - Ecole Polytechnique Fédérale de Lausanne
"Laboratory of Photonics and Quantum Measurements"
SB-LPQM, Station 3, CH-Lausanne, Switzerland
Citizenship: Germany / Swiss (dual nationality)
Date of birth: 8th Nov. 1976
Marital status: Married, two children (Maximilian, 11.07.2021 and Felix, 15.03.2024)
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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

Swiss Federal Institute of Technology 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

- **R.W. Wood Prize** (for pioneering contributions to chip-scale optical frequency combs) 2021
- **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

Member of German National Academy of Sciences Leopoldina	2024
International Member United States National Academy of Engineering (NAE)	2024
Member of the Swiss Academy of Engineering Sciences (SATW)	2023
ERC Advanced Grant (2nd)	2019
Optical Society of America Fellow	2018
American Physical Society Fellow	2016
Clarivate Analytics ISI Highly cited in Physics (top 1% in domain of Physics)	2014 - 2019
ERC Advanced Grant	2012
ERC Starting Grant	2007
Marie Curie Excellence Grant	2006
Studienstiftung der Deutschen Volkes	1998 - 2002

RESEARCH INTERESTS

Quantum measurement of mechanical motion (quantum optomechanics) and integrated nonlinear optical devices, in particular chip-scale frequency combs (microcombs)

OFTEN QUOTED PUBLICATION METRICS

- **Clarivate Analytics http://www.highlycited.com/ in Physics (1% top cited)** in 2014 to 2023 (ongoing)
- Total number of citations to date: WoK > 43,300 (GoS: >69'000) – 8100 cited/year
- Journal publications : Nature (20), Science (13), Nature Photonics (14), Comm. (33), Physics (11), Nanotech (4), PRL (23). **Complete list found at https://www.epfl.ch/labs/k-lab/publications**
- 10 research papers with more than 1000 citations
- Hirsch-Index (N papers cited N times): WoK: 91 (GoS: 108)

INVITED TALKS

More than **323 invited talks** (16 plenary talks). A list can be found on my group website at https://www.epfl.ch/labs/k-lab/wp-content/uploads/Kippenberg_ListTalks_Sept2024.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 laid the foundation to the the field of ultra-high Q microresonators. Cited >2000 times in GoS]
- 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.**]**
- First demonstration of radiation pressure cooling of a mechanical oscillator (simultaneously with A. Heidmann and A. Zeilinger) – ***Phys. Rev. Lett.*** (2006) [Experiments triggered methods for ground state cooling of mechanical oscillators using radiation pressure cooling**]**
- Discovery of microresonator based optical frequency combs – ***Nature*** (2006) [This observation created a new research field at intersection of frequency metrology, nonlinear photonics, and microresonator Physics producing >1000 papers to date. Cited more than 1500 times GoS]
- First quantum theory of radiation pressure cooling (jointly with Wilhelm Zwerger, simultaneous to S. Girvin and F. Marquardt) – ***Phys. Rev. Lett.*** (2007) [This paper identified the quantum limit of radiation pressure cooling, cited >900 GoS]
- First demonstration of resolved sideband cooling of a mechanical oscillator – ***Nature Physics*** (2008) [Demonstration of sideband cooling of a mechanical oscillator, a key technique widely used in quantum optomechanics**]**
- First measurements at the standard quantum limit of mechanical imprecision – ***Nature Physics*** (2009)
- 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 "soliton micro-combs" producing >2000 papers to date. Cited >1000 times GoS]
- 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) [This paper inspired experiments that explored optomechanical effects in molecular vibrations**]**
- Observation soliton induced Cherenkov radiation in an optical microresonator – ***Science*** (2016) [This paper demonstrated dissipative solitons on a photonic chip**]**
- Terabit communications with photonic chip soliton frequency combs (with C. Koos) – ***Nature*** (2017)
- Demonstration of room temperature quantum correlations – ***PRX*** (2017) [This paper along with work from NIST Gaithersburg, demonstrated room temperature quantum optomechanical effects**]**
- Ultrafast optical ranging with microresonator soliton combs (jointly with C. Koos) – ***Science*** (2018)
- Highest Q of a room temperature mechanical oscillator using strain engineering - ***Science*** (2018)
- Massively parallel LiDAR using soliton microcombs, ***Nature*** (2020)
- A integrated turnkey microcombs [jointly with K.Vahala, J. Bowers] ***Nature*** (2020)
- Piezoelectric control of soliton microcombs [with Sunil Bhave], ***Nature*** (2020)
- Parallel convolutional processing using an integrated photonic tensor core [jointly with W. Pernice & co-workers], ***Nature*** (2021)
- Laser soliton microcombs heterogeneously integrated on silicon [jointly with J. Bowers], ***Science*** (2021)
- Integrated photonics enables continuous-beam electron phase modulation [jointly with C. Ropers], ***Nature*** (2021) [This paper demonstrated for the first time electron photon interactions in the continuous wave regime**]**

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

- A photonic integrated circuit-based erbium-doped amplifier, ***Science*** (2022) [This paper demonstrated for the first time an Erbium amplifier with commercial grade performance on chip]
- Cavity-mediated electron-photon pairs, [jointly with C. Ropers], ***Science*** (2022)
- Superconducting circuit optomechanics in topological lattices, ***Nature*** (2022)
- Demonstration of a traveling wave optical parametric amplifier, ***Nature*** (2022)
  [This paper demonstrated for the first time a net gain traveling wave parametric amplifier on chip]
- Ultrafast tunable lasers using lithium niobate integrated photonics [jointly with P. Seidler], ***Nature*** (2023)
- Room-temperature quantum optomechanics using an ultra-low noise cavity, *accepted in* ***Nature*** (2024)
- Free-electron interaction with nonlinear optical states in microresonators, ***Science*** (2024)
- Lithium tantalate electro-optical photonic integrated circuits for high volume manufacturing, ***Nature*** (2024)

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). These efforts have contributed to their future success as independent scientists, with *18 secured positions as group leader or professor* (8 in the field of optomechanics). I also actively scout Prizes for my co-workers, resulting in 3 EPS-QEOD best thesis prizes, The Latsis Prize, IOP best thesis award, Otto-Hahn Medal, and Helmholtz Prize. Two of my students obtained the EPFL Doctorate Award.

Academic appointments of co-workers and prizes:

1. Prof. Albert Schliesser, University of Copenhagen, **Full Professor** (*ERC Grantee, EPS Thesis Prize, Otto Hahn Medal, Latsis Prize*)
2. Dr. Pascal Del'Haye, Group Leader MPI Erlangen (*EPS Thesis Prize, Helmholtz Prize of Metrology*)
3. Prof. Dr. Tobias Herr, **Assistant Professor** DESY Hamburg (*IOP best thesis award, EPS Thesis Prize, ERC Grantee*)
4. Prof. Ewold Verhagen, Group Leader AMOLF, Professor at Eindhoven (*ERC Grantee, Marie Curie IF*)
5. Prof. Pierre Verlot, **Assistant Professor**, University of Nottingham (*ERC Grantee*)
6. Dr. Olivier Arcizet Permanent Researcher, CNRS, France (*ERC Grantee*)
7. Dr. Samuel Deléglise, **Associate Professor**, LKB - OMQ (*Marie Curie IF)*
8. Dr. Christine Wang, DRAPER Laboratory (*Marie Curie IF)*
9. Prof. Christophe Galland, **SNF Professorship**, EPFL (*ERC Grantee, SNF Ambizione Fellowship*)
10. Dr. Caroline Lecaplain, Research Professor, University of Arizona (*Marie Curie IF*)
11. Prof. Dalziel Wilson, **Assistant Professor** of Optical Sciences, University of Arizona (*Marie Curie IF*)
12. Prof. Hairun Guo, **Assistant Professor**, Shanghai University (*Marie Curie IF*)
13. Prof. Vivishek Sudhir, **Assistant Professor**, Massachusetts Institute of Technology
14. Prof. Itay Shomroni, **Assistant Professor**, Hebrew University of Jerusalem (*Marie Curie IF*)
15. Prof. Junqiu Liu, **Assistant Professor**, Univ. Science & Technology China (*EPFL Doctorate Award*)
16. Dr. Erwan Lucas, Permanent Researcher, CNRS, France (*EPFL EDPO best thesis award*)
17. Prof. Nils Engelsen, **Assistant Professor**, Chalmers Univ. (*ERC Grantee, SNF Ambizione Fellowship*)
18. Prof. Johann Riemensberger, **Assistant Professor**, Norwegian Institute of Technology (*SNF Ambizione Fellowship*)
19. Prof. Yang Liu, **Assistant Professor**, Huazhong University of Science and Technology (HUST), China (*Marie Curie IF*)

Industrial appointments of co-workers and technology transfer (selected):

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

INDUSTRIAL INNOVATION

- I co-founded **LIGENTEC S.A.** (https://www.ligentec.com, 2016), a company commercializing tightly confining ultra-low loss Si_3N_4 integrated photonic circuits (PIC) that I have developed in my lab since 2011 as a pure play foundry service, and manufactured using proprietary and patented techniques developed in my laboratory. LIGENTEC manufactures today in a 200 mm automotive CMOS line at **X-Fab in France**,

constituting the **largest capacity foundry offering of photonic integrated circuits in Europe**[2]. www.ligentec.com

- I co-founder of **DEEPLIGHT S.A**. (https://deeplight.ai, 2021), a company commercializing photonic integrated light sources based on the combination of piezoelectrical actuators and ultra-low loss silicon nitride PICs as developed in collaboration with Sunil Bhave in Purdue.
- I am co-founder of **LUXTELLIGENCE S.A.** (https://luxtelligence.ai, 2022), a lithium niobate pure-play foundry based on a novel deep etching technology developed by my lab based on diamond-like carbon (DLC). The company democratized access to ferroelectric photonic integrated circuits (LTOI and LNOI).

SERVICE TO THE ACADEMIC COMMUNITY

I have taken an active role in organizing topical meetings around quantum optomechanics and microresonator frequency combs, and have been the sole organizer of several (6) *Monte Verità* workshops:

- Organizer of Monte Verità Workshop "Quantum Optics of Micro and Nanomechanical Systems", 2019, 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 of the Gordon Research Conference "Mechanical Systems at the Quantum Limit", 2012

SCIENTIFIC COORDINATOR OF RESEARCH NETWORKS

I have taken a vested interest in shaping the European cavity quantum optomechanics and optical frequency comb communities for being the ***sole coordinator*** of ***four largescale networks***:

- Coordinator of DARPA OpTIm 2023 – 2027 (USD 2.6 Mio)
- Coordinator of FET-Open "TeraSlice" 2020-2023 (€3.6 Mio)
- Coordinator of FET-Proactive "Hybrid Optomechanical Technologies" 2017-2021 (€10 Mio)
- Coordinator of Marie Curie Training Network "Optomechanical Technologies" 2016-2020 (€3.9 Mio)
- Coordinator of Marie Curie Training Network "Cavity Quantum Optomechanics" 2012-2016 (€5.7 Mio)

FUNDING RECORD

I raised more than 49 million CHF in 2013-2024 **for my laboratory**. This includes performing in more than 7 DARPA programs (ORCHID, SCOUT, PULSE, DODOS, LUMOS, NAPSAC, OPTIM) and receiving funding from the AFOSR. The breakdown of funding for my lab from 2013-2024 (11 years) includes:

- EU Funding: **23.48 Mio CHF** (44.80%)
- Swiss National Science Foundation: **11.31Mio CHF** (23.46%)
- US DARPA and AFOSR: **11.98 Mio CHF** (25.59%)
- European Space Agency: **0.86 Mio CHF (**1.84%)
- Industry: **1.17 Mio CHF (**2.5%)
- Other: **0.94 Mio CHF (**1.8%)

[2] https://www.xfab.com/news/details/article/ligentec-and-x-fab-collaboration-creates-europes-largest-capacity-foundry-service-for-integrated-photonic-circuits