Professor Tobias J. Kippenberg
Full Professor of Physics and Electrical Engineering
Swiss Federal Institute of Technology Lausanne (EPFL)
Switzerland

School of Basic Sciences
Professor Paul J. Dyson, Dean

Lausanne, 12 November 2021

Selection Committee
Albert Einstein World Award of Science

Dear Members of the Selection Committee,

Hereby I wish to nominate Professor Tobias Kippenberg for the Albert Einstein World Award of Science.

Tobias Kippenberg heads the Laboratory of Photonics and Quantum Measurements at the Ecole Polytechnique Fédérale de Lausanne, Switzerland and has made transformative contributions over the last two decades to the fields of quantum physics and nonlinear optics, establishing himself as an extraordinary visionary leader in these domains. His series of impressive experiments with optical frequency combs and nonlinear optics, combined with his outstanding ability to design and fabricate complex solid-state microstructures with record performance, are paving the way to a revolution in quantum science and technology, with a huge impact in optical communication, data processing, and active optical imaging.

Tobias Kippenberg is at the origin of a true paradigm shift in the field of optical frequency combs, starting with the demonstration of the first on-chip, monolithic, micron-sized optical frequency comb in 2007. As detailed in the scientific achievements, this breakthrough has not only opened a new field of research, but his team has also enabled the development of many applications with impressive improvement in performance, size, and power consumption with respect to the state-of-the-art. These chips promise great benefit for the sustainable development of ultra-fast data processing and telecommunication, with substantially reduced environmental impact. The discovery and subsequent development of microcombs represent an outstanding achievement for the benefit of humanity, making Tobias Kippenberg a highly worthy candidate for the Albert Einstein World Award of Science.

I do hope the Selection Committee will consider this nomination and I remain available for any further information.

Paul J. Dyson

Dean, School of Basic Sciences, EPFL

SB School

EPFL SB–DO
PH A2 364 (Bâtiment PH)
Station 3
CH - 1015 Lausanne

Phone : +41 21 693 34 15
E-mail : FSBDean@epfl.ch
Website : sb.epfl.ch

UNIVERSITA' DEGLI STUDI DELL'INSUBRIA
via Valleggio 11, 22100 Como telefono 031 2386111 – fax 031 2386119

To the Selection Committee

of the Albert Einstein

World Award of Science Como 23/10/2021

Dear Colleagues,

it is an honour for me, and a special pleasure, to write this letter in support of the nomination of Professor Tobias Kippenberg to the Albert Einstein World .Award of Science. From my viewpoint he is definitely one of the most outstanding figures in the field of optics, at world level, and his work has produced a literally enormous impact on the research activities of this scientific community.

I am quite familiar with his scientific production, concerning the so-called Kerr frequency combs, also because it has subsequently turned up to be closely related to an old work of mine (the so-called Lugiato-Lefever equation).

The realization of this phenomenon using sophisticated microresonators of extremely high quality containing a Kerr medium, that he achieved as leader of an independent junior research group at Max Planck Institute of Quantum Optics in Garching in 2007, opened an entirely novel avenue in the field of photonics. The first point that must be appreciated is that the physical mechanism which generates the combs is entirely different from that in pulsed mode-locked lasers, and is based on the spectacular sequence of four-wave mixing processes that arise from the interaction of the monochromatic light injected into the microcavity with the Kerr medium. Not only the comb has a spectral bandwith that can span an octave, far beyond that obtained using mode-locked lasers, but, especially, it is synthetized in a compact device characterized by a chip scale, for the first time with repetition rates in the gigahetrtz regime that is technologically most relevant. This scenario has primed a world scale

Università degli Studi dell'Insubria - Polo di Como
Dipartimento di Scienze CC.FF.MM. – via Valleggio, 11- 22100 Como
Tel. +39 (031) 238 6111 Fax +39 (031) 238 6209

interest and research activity , both experimental and theoretical, in this topic.

A basic step further was that Kippenberg discovered in 2014 (actually his arXiv paper is dated 2013) the dissipative cavity solitons in microresonators. These are short optical pulses originated by a gain vs loss mechaism arising from the interplay of the Kerr nonlinearity with dispersion and represent ideal subjects for fundamental nonlinear science as well as ideal carriers for a variety of applications. Since then the Kerr combs associated to such cavity solitons have been demonstrated in a wide variety of configurations, including chipscale silica disks and integrated devices.

Today Kerr frequency comb generation is a mature field and the technology has been applied to numerous areas, including coherent telecommunications, spectroscopy, atomic clocks as well as laser ranging and astrophysical spectrometer calibration. In particular, the discovery of Kerr cavity solitons has enabled important results such as, for example, dual soliton comb based distance measurements, dual comb spectroscopy, counter-clockwise solitons, dual soliton comb based distance measurements, frequenct synthesis on chip.

I am impressed also by his recent works in Nature (2020) on massively parallel coherent laser ranging using soliton microcombs, in Nature Photonics (2020) on photonic microwave generation in the X- and K-band, in Science Advances (2020) on frequency division using a semiconductor frequency comb, in Nature (2021) on parallel convolution processing using an integrated photonic tensor core. These articles provide a technological basis for compact massive LIDAR systems, establish integrated microcombs as viable microwave generators, revolutionize the market for portable low-noise microwave sources, demonstrate the potential of integrated photonics for parallel computational hardware in artificial intelligence applications.

Quite evidently, Kippenberg's investigations have encompassed both fundamental and applied aspects of optical systems. He has published his results in the journals of highest impact factor. The number of citations of

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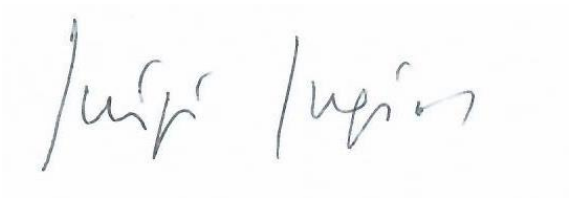
his papers is simply astonishing, and demonstrates quantitatively the tremendous impact of his work, which has opened new perspectives and is pregnant of important further spectacular applicative progress. The Albert Einstein World Award of Science, that recognizes scientific and technological achievements bringing true benefits to humanity, seems tailormade for Tobias Kippenberg. It is evident to me that he is an ideal candidate for this prestigious recognition.

With kindest regards,



Luigi Lugiato

Università degli Studi dell'Insubria - Polo di Como
Dipartimento di Scienze CC.FF.MM. – via Valleggio, 11- 22100 Como
Tel. +39 (031) 238 6111 Fax +39 (031) 238 6209

LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

FAKULTÄT FÜR PHYSIK
CARL FRIEDRICH VON SIEMENS LEHRSTUHL
PROFESSOR DR. THEODOR W. HÄNSCH

Schellingstraße 4/III, D-80799 München, Germany

Telefon: +49 (0)89 21 80-32 12
Telefax: +49 (0)89 28 51 92
Email: t.w.haensch@lmu.de

November 8, 2021
HÄNSCH/GG

Nomination of Prof. Tobias Kippenberg, EPFL,
for the Albert Einstein World Science Award: Letter of Support

Ladies and Gentlemen of the Selection Committee
of the Albert Einstein World Award in Science!

It gives me pleasure to write this letter to support the nomination of Tobias Kippenberg, EPFL Lausanne, for the Albert Einstein World Award in Science. His discovery of frequency-comb generation by micro-fabricated chip-scale optical resonators and their subsequent developments towards applications represent impressive achievements, opening new frontiers in photonics technology, ultra-fast data processing and telecommunication.

Since 1986, I have been a Director at the Max-Planck-Institute of Quantum Optics (MPQ) at Garching, Germany, and Professor of Physics at the Ludwig-Maximilian University (LMU) in Munich. In 2005, John L. Hall and myself shared half of the Physics Nobel Prize for our work on precision laser spectroscopy, including the frequency comb technique. Laser frequency combs based on mode-locked lasers have made it possible to precisely count the cycles of a light wave, and they have revolutionized precision measurements, opening new applications from optical atomic clocks to highly multiplexed molecular spectroscopy.

I have known Tobias Kippenberg personally since 2005, when I hosted him and his independent Max-Planck Research group in our laboratory at the MPQ. From the beginning, he impressed me as an exceptionally effective, ambitious, and original young scientist. Dr. Kippenberg built his research program at Garching around microfabricated toroidal ring resonators of high finesse, as pioneered by his thesis advisor at Caltech, Prof. Kerry Vahala. Recognizing the optomechanical coupling between excited optical modes and radial mechanical breathing modes of his silica microresonators, he soon demonstrated optical cooling of selected mechanical modes by radiation pressure. With careful theoretical analysis he identified sideband cooling as a viable path towards laser cooling to the quantum mechanical ground state of a microscopic mechanical structure.

In the course of this work, Dr. Kippenberg and his team discovered unexpectedly that cascaded four wave mixing in a microcavity can produce a perfectly evenly spaced frequency comb that can span an entire octave. Such microcombs offer revolutionary advantages over

pre-existing comb technology, such as uniquely large comb-mode spacings in the tens or hundreds of gigahertz range, and monolithic construction with small size and power consumption. Kippenberg's team and collaborators have already demonstrated the use of microcombs for numerous applications with large improvements in performance, efficiency, and reduction of energy consumption.

With the discovery of microcombs, Tobias Kippenberg and his team have opened a new field of research at the intersection of metrology and nano- and micro-photonics, as well as nonlinear optics, which has led to numerous advances by dozens of highly recognized experimental and theoretical research groups. Microresonator Kerr combs have now been demonstrated in a variety of platforms. In addition, Kippenberg's research, with different collaborators, discovered dissipative cavity solitons in optical micro- resonators, their ability to generate fully coherent optical frequency combs starting from continuous-wave pumping, as well as the existence of perfect soliton crystal states enabling to decouple the pulse repetition rate from the micro-resonator size.

Tobias Kippenberg has also demonstrated wavelength-division multiplexed lightwave communication with a cavity-soliton-based comb providing up to 179 distinct optical carriers. These can be individually encoded with data, supporting an aggregate transmission rate beyond 50 Tb·s−1 over a 75 km span of fibre. The use of comb sources dramatically increases scalability and enables highly parallel coherent data transmission with light, opening the way for highly efficient chip-scale transceivers for future petabit networks.

In the light of these exceptional achievements, I consider Professor Tobias Kippenberg a compelling candidate for the Albert Einstein World Award in Science, and I recommend him with my strongest enthusiasm.

Sincerely yours,

Professor Theodor W. Hänsch

Scientific achievements

Relevant to the nomination of Prof. Tobias J. Kippenberg

The development of optical frequency combs, for which John Hall and Theodor W. Hänsch shared the Physics Nobel Prize in 2005, has enabled counting of the electromagnetic field cycles of light ($\nu = 10^{15}$ Hz) and heralded a paradigm shift in optical precision measurements, timekeeping, (ultrafast) spectroscopy and laser technology. In 2007, the team of Tobias Kippenberg reported the discovery of a revolutionary method* [1] to generate optical frequency combs using parametric frequency conversion in micron-sized optical cavities, which were fabricated directly on conventional silicon wafer substrates. Such microcombs offer revolutionary advantages over pre-existing comb technology, including chip-based photonic integration, uniquely large comb-mode spacings in the tens of gigahertz range, and monolithic construction with small size and low power consumption. Tobias Kippenberg and his team have since been at the forefront of the emerging field of optical microcombs, contributing key breakthroughs on the theoretical description of the fundamental dynamics of driven nonlinear systems far from equilibrium [2] including the seminal demonstration of spontaneous formation of dissipative Kerr solitons in optical microresonators [3].

Moreover, Tobias Kippenberg along with his team and numerous international collaborators have demonstrated the generation of microcombs in planar silicon nitride based integrated photonic circuits [4] for high-impact applications in optical communication, data processing, and active optical imaging with huge improvement in performance, efficiency, and energy saving potential. Therefore, the discovery of microcombs represents an impressive achievement for the benefit of humanity.

The generation of optical frequency combs in microresonators demonstrated in 2007 by Kippenberg's team [1] was a remarkable breakthrough. This unexpected observation broke with the conventional dogma that optical combs can only be generated with mode-locked pulsed laser sources. This method made it possible to synthesize optical combs in compact devices that can be micro-fabricated on chip, with unprecedented high repetition rates in the technologically relevant gigahertz regime, and with optical bandwidths that are far beyond what can be achieved with conventional mode-locked lasers.

The original report [1] has opened a new field of research at the intersection of metrology and nano- and micro-photonics and nonlinear optics, which has led to numerous advances by dozens of highly recognized experimental and theoretical research groups. Microresonator Kerr combs have now been demonstrated in a variety of platforms. In addition, Kippenberg's research, with different collaborators, discovered the universal dynamics of Kerr combs [2] and dissipative cavity solitons in optical microresonators [3], their ability to generate fully coherent optical frequency combs in compact planar lightwave circuits based on silicon nitride [4].

Following these discoveries, the laboratory of Tobias Kippenberg and their collaborators have demonstrated how microcombs can be applied in many areas while significantly surpassing the performances of state-of-the-art devices. A few examples are listed here:

* Numbers in brackets refer to the list of most important publications provided with the nomination.

- Impressive wavelength-division multiplexed lightwave communication was demonstrated with a cavity-soliton-based combs providing up to 179 distinct optical carriers that can be individually encoded with data, supporting an aggregate transmission rate beyond 50 $Tb \cdot s^{-1}$ over a 75 km span of fibre [5]. The use of comb sources dramatically increases scalability and enables highly parallel coherent data transmission with light, opening the way for highly efficient chip-scale transceivers for future petabit networks.
- A massively parallel coherent LIDAR scheme was demonstrated using an ultra-low-loss photonic chip-based soliton microcomb, with 30 distinct channels capable of measuring both distance and velocity at an equivalent pixel-sampling rate of three megapixels per second [6]. This approach provides a technological basis for compact, massively parallel and ultrahigh-frame-rate coherent LIDAR systems.
- Soliton microcombs were demonstrated to operate in two widely employed microwave bands, the X-band (~10 GHz, for radar) and the K-band (~20 GHz, for 5G) [7]. These results establish integrated microcombs as viable low-noise microwave generators for microwave photonic systems.
- A photonic processor, based on phase-change-material memory arrays and photonic chip-based optical frequency combs, has achieved massively parallelized photonic in-memory computing, with an impressive 10^{12} multiply-accumulate operations per second [8]. This demonstrates the huge potential of integrated photonics for parallel, fast, and efficient computational hardware in data-heavy artificial intelligence applications.

The promising future of photonic integrated optical frequency comb technology for low power optical instruments crucially depends on the further miniaturization and integration of optical microcomb technology into small and efficient form factors and their manufacture at-scale. The team of Tobias Kippenberg, along with numerous collaborators in the field of silicon photonics, has very recently achieved two major breakthroughs:

- Full control and initiation of a soliton microbombs using a monolithically integrated piezo-electric actuator was demonstrated in 2020 [9]. Such actuators are manufactured with established foundry processes for micro-electro-mechanical systems (MEMS) and feature ultra-low power consumption, high actuation bandwidth and high precision for applications in wavelength division multiplexing and LIDAR.
- Heterogeneous integration of an ultra-low loss optical microresonator and an active III-V semiconductor gain section was demonstrated in 2021 [10]. This allows not only to fully leverage modern semiconductor manufacture techniques for frequency comb manufacture: a single 4-inch silicon wafer contains more than 4000 frequency comb devices. Now, at-scale manufacture of optical frequency combs for applications in datacenters or cars becomes possible.

Optical frequency combs in microresonators have offered revolutionary advantages over the comb technology existing at the beginning of the 21st century, including chip-based photonic integration, uniquely large comb-mode spacings in the tens of gigahertz range, and monolithic construction with small size and power consumption. The above proof of concept applications, control, and manufacture at scale have positioned soliton microcombs at the cusp of widespread adoption. Their impressive improvement in performance, size, and power consumption with respect to the state-of-the-art, promise great benefit for the sustainable development of ultra-fast data processing and telecommunication, with a reduced environmental impact.

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

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

ERC Advanced Grant (2nd)	2019
Optical Society of America Fellow	2017
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 comsb (microcombs)

OFTEN QUOTED PUBLICATION METRICS

- **Clarivate Analytics http://www.highlycited.com/ in Physics (1% top cited) –** 2014-2020
- Total number of citations to date: WoK > 29,000 (GoS: >45,000) – 5900 cited/year
- Hirsch-Index (N papers cited N times): WoK: 74 (GoS: 88)
- Journal publications : Nature (14), Science (9), Nature Photonics (12), Comm. (20), Physics (8), Nanotech (3), PRL (23).
- **For a complete list of publications, please refer to https://www.epfl.ch/labs/k-lab/publications/**

INVITED TALKS

More than **297 invited talks** (13 plenary talks). A list can be found on my group website at https://www.epfl.ch/labs/k-lab/wp-content/uploads/2021/10/Kippenberg_ListTalks_Oct-2021.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 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 "soliton micro-combs" a field at intersection of frequency metrology, nonlinear photonics, and microresonator Physics 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 of soliton switching in micro-resonators – ***Nature Physics*** (2016)
- Observation soliton induced Cherenkov radiation in an optical microresonator – ***Science*** (2016)
  [This paper demonstrated dissipative solitons on a photonic chip]
- Demonstration of quantum correlations in feedback cooling – ***Phys. Rev. X*** (2017)
- A dissipative quantum 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) [This paper along with work from NIST Gaithersburg, was 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, ***Nature*** (2020)
- Parallel convolutional processing using an integrated photonic tensor core [jointly with W. Pernice & co-workers], ***Nature*** (2021)
- Laser soliton microcombs heterogeneously intergrated on solicon [jointly with J. Bowers], ***Science*** (2021)
- Integrated photonics enables continuous-beam electron phase modulation [jointly with C. Ropers], ***Nature*** (accepted, 2021)

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

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 scientist, with 13 *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. Two of my students obtained the EPFL best thesis award.

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. Prof. Dr. Tobias Herr, Assistant Professor DESY Hamburg (*IOP thesis award*)
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 Delélise, CR- LKB ENS group leader (*Marie Curie IF)*
8. Dr. Christine Wang, DRAPER Laboratories (*Marie Curie IF)*
9. Prof. Christophe Galland, SNF Professorship at EPFL
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 I*F)
13. Prof. Vivishek Sudhir, Assistant Professor, MIT
14. Prof. Itay Shomroni, Assistant Professor, Hebrew University of Jerusalem (*Marie Curie IF*)

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

- 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
- G. Anetsberg Patent Lawyer (Munich), J. Dobrindt (McKinsey Consulting Munich), R. Riviere, Technical Manager (Airbus Munich)

INDUSTRIAL INNOVATION

I founded (jointly with two postdocs) **the start-up company LIGENTEC SA** that commercializes my laboratories developed ultra-low loss Si_3N_4 integrated photonic circuits (PIC) as a foundry service, manufactured using proprietary and patented techniques developed in my laboratory. The company exists since 2016.

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 (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 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 and optical frequency comb communities for being the ***sole coordinator*** of ***four largescale networks***:

- Coordinator of FET-Open "TeraSlice" 2020 – 2022 (€3.6 Mio)
- Coordinator of FET-Proactive "Hybrid Optomechanical Technologies" 2016-2020 (€10 Mio)
- Coordinator of Marie Curie Training Network on "Optomechanical Technologies" 2016-2020 (€3.9 Mio)
- Coordinator of Marie Curie Training Network on "Cavity Quantum Optomechanics" 2012-2016 (€5.7 Mio)

10 most important publications

Relevant to the nomination of Prof. Tobias Kippenberg

1. P. Del Haye. A. Schliesser, O. Arcizet, T. Wilken, R. Holtzwarth, T.J. Kippenberg
   "Optical frequency comb generation from a monolithic microresonator"
   Nature **450** 1214–1217 (2007) *& Nature News and Views*
2. T. Herr, K. Hartinger, J. Riemensberger, C.Y. Wang, E. Gavartin, R. Holzwarth, M.L. Gorodetsky, and T.J. Kippenberg
   "Universal formation dynamics and noise of Kerr-frequency combs in microresonators" *Nature photonics* **6** 480-487 (2012)
3. 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 **8** 145–152 (2014)
4. 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 **351** 357-360 (2016)
5. P. Marin-Palomo, J. N. Kemal, M. Karpov, A. Kordts, J. Pfeifle, M. H. P. Pfeiffer, P. Trocha, S. Wolf, V. Brasch, R. Rosenberger, K. Vijayan, W. Freude, T. J. Kippenberg, C. Koos
   "Microresonator-based solitons for massively parallel coherent optical communications"
   Nature **546** 274–279 (2017) & *Nature News and Views*
6. J. Riemensberger, A. Lukashchuk, M. Karpov, W. Weng, E. Lucas, J. Liu, T. J. Kippenberg
   "Massively parallel coherent laser ranging using soliton microcombs"
   Nature **581** 164–170 (2020)
7. J. Liu, E. Lucas, A. S. Raja, J. He, J. Riemensberger, R. N. Wang, M. Karpov, H. Guo, R. Bouchand and T. J. Kippenberg
   "Photonic microwave generation in the X- and K-band using integrated soliton microcombs"
   Nature Photonics **14** 486–491 (2020)
8. J. Feldmann, N. Youngblood, M. Karpov, H. Gehring, X. Li, M. Stappers, M. Le Gallo, X. Fu, A. Lukashchuk, A.S. Raja, J. Liu, C.D. Wright, A. Sebastian, T.J. Kippenberg, W.H.P. Pernice, H. Bhaskaran
   "Parallel convolution processing using an integrated photonic tensor core"
   Nature **589** 52–58 (2021)
9. J. Liu, H. Tian, E. Lucas, A.S. Raja, G. Lihachev, R.N. Wang, J. He, T. Liu, M.H. Anderson, W. Weng, S. Bhave, T.J. Kippenberg
   " Monolithic piezoelectric control of soliton microcombs "
   Nature **583** 385-390 (2020)
10. C. Xiang, J. Liu, J. Guo, L. Chang, R.N. Wang, W. Weng, J. Peters, W. Xie, Z. Zhang, J. Riemensberger, J. Selvidge, T.J. Kippenberg, J.E. Bowers
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PUBLICATION METRICS

- **Clarivate WoS** https://recognition.webofscience.com/awards/highly-cited/2020/ **in Physics (1% top cited)** in 2014-2020
- Total number of citations to date: WoS > 29,000 (GoS: >45,000) – 5900 cited/year
- Hirsch-Index (N papers cited N times): WoS: 74 (GoS: 88)
- Journals : ***Nature 14, Science 9, Nature sub-journals 39 (Photonics 12, Comm. 20, Physics 8, Nanotech 3), Phys. Rev. Lett 23***

PEER REVIEWED PUBLICATIONS AS PRINCIPAL INVESTIGATOR AND (CO-) CORRESPONDING AUTHOR

For a complete list, please refer to https://www.epfl.ch/labs/k-lab/publications/

1. H. Tian, J. Liu, A. Siddharth, R. N. Wang, T. Blésin, J. He, T. J. Kippenberg, S. A. Bhave
"Magnetic-Free Silicon Nitride Integrated Optical Isolator"
Nature Photonics (2021)
2. A. S. Raja, S. Lange, M. Karpov, K. Shi, X. Fu, R. Behrendt, D. Cletheroe, A. Lukashchuk, I. Haller, F. Karinou, B. Thomsen, K. Jozwik, J.Liu, P.Costa, T. J. Kippenberg, H. Ballani
"Ultrafast optical circuit switching for data centers using integrated soliton microcombs"
Nature Communications (2021)
3. W. Weng, M. Anderson, A. Siddharth, J. He, A. S. Raja, T. J. Kippenberg
"Coherent terahertz-to-microwave link using electro-optic-modulated Turing rolls"
Physical Review A (2021)
4. K. Komagata, A. Tusnin, J. Riemensberger, M. Churaev, H. Guo, A. Tikan, T. J. Kippenberg
"Dissipative Kerr solitons in a photonic dimer on both sides of exceptional point"
Communications Physics (2021)
5. M. Bereyhi, T. J. Kippenberg
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136. E. Sahin, B. Zabelich, O. Yakar, E. Nitiss, J. Liu, R. N. Wang, T. J. Kippenberg, C.-S. Brès
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137. Y. J. Joshi, N. Sauerwein, A. Youssefi, P. Uhrich, T. J. Kippenberg
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203. J. Riemensberger, J. Liu, N. Kuznetsov, J. He, R. N. Wang, T. J. Kippenberg
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"Microwave-to-optical conversion with a gallium phosphide photonic crystal cavity"

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