



WOMBAT PROGRAM

3 - 5 JULY 2017

Workshop on Optomechanics
and Brillouin Scattering:
Fundamentals, Applications
and Technologies

Student presentation Award sponsored by

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INVITED PRESENTATIONS
KEYNOTE ADDRESS
TUTORIALS
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▼ FEMTO-ST INSTITUTE
BESANÇON, FRANCE

▼ <http://events.femto-st.fr/WOMBAT-2017>

SPONSORS

The WOMBAT Committee gratefully acknowledges the following sponsors for their support of the Workshop on OptoMechanics and Brillouin scattering: fundamentals, Applications and Technologies (WOMBAT).



APL Photonics, sponsor of the best student presentation

As a committed supporter of excellence in student research, APL Photonics supports Best Student presentation Award at WOMBAT 2017. The award is designed to encourage and acknowledge excellence in oral student paper presentation.

AIP
Sponsorship

The winner will be selected at the conference by the Best Student Oral Presentation Award Committee on Wednesday July 5. The award consists of a prize of \$750 and certificate for the winner, as well as a free Article Processing Charge (APC) waiver* (2,200 USD value) for the publication of an article in APL Photonics.

APL Photonics is the new dedicated home for open access multidisciplinary research from and for the photonics community. The journal publishes fundamental and applied results that significantly advance the knowledge in photonics across physics, chemistry, biology and materials science.

Editor-in-Chief: Benjamin Eggleton
Director, CUDOS, School of Physics, University of Sydney, Australia

*Pending peer review and acceptance of the article. The waiver can be redeemed for one accepted article and is valid for one year.

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CHAIRS' WELCOME MESSAGE

Welcome!

After the great success of the first workshop in Sydney in 2015, the second WOMBAT workshop is organized in Besançon at the FEMTO-ST headquarters at Temis in Besançon on 3-5 July 2017. It brings together european and international researchers in the field of physics and applications of opto-mechanics and Brillouin light scattering.

The symposium will celebrate the fact that it will be soon 100 years that the theory of light scattering in transparent materials was introduced by Brillouin in 1922. We have assembled a fantastic programme of speakers who will consider the many ways Brillouin scattering and optomechanics do play an essential role in photonics. The symposium will be held in the spirit of a lively and constructive debate with interruptions and questions encouraged.

We are very pleased to welcome you in Besançon and we wish you a nice and lively workshop.



Dr. Jean-Charles Beugnot
FEMTO-ST/CNRS

A handwritten signature in black ink, appearing to read 'Beugnot'.



Dr. Vincent Laude
FEMTO-ST/CNRS

A handwritten signature in blue ink, appearing to read 'Laude'.



Dr. Thibaut Sylvestre
FEMTO-ST/CNRS

A handwritten signature in black ink, appearing to read 'Sylvestre'.



Special Issue

Brillouin Scattering and Optomechanics

Guest Editors:

Dr. Jean-Charles Beugnot

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*Deadline for manuscript
submissions:
31 December 2017*

Message from the Guest Editors

The science of the interaction of sound and light, including acousto-optics, has recently witnessed the emergence of new topics and directions that lead to novel fundamental effects and applications. Optomechanical structures, including phoxonic crystals—also known as simultaneous photonic and phononic crystals—are presently being investigated in order to obtain very efficient interactions in tiny volumes. They allow for the control of phonons with photons, but also for ultimate sensing applications. Concurrently, opto-acoustical interactions in micro- and nanoscale optical resonators, fibers, and waveguides are being seen in a new light thanks to new materials and structures, leading to a renewed view of Brillouin scattering.

Author Benefits

Open Access: free for readers, with publishing fees paid by authors or their institutions.

High visibility: Indexed by the **Science Citation Index Expanded** (Web of Science) [search for "Applied Sciences-Basel"], Scopus, INSPEC (IET) and other databases.

Rapid publication: manuscripts are peer-reviewed and a first decision provided to authors approximately 24 days after submission; acceptance to publication is undertaken in 8 days (median values for papers published in this journal in 2016).

Further info:

http://www.mdpi.com/journal/applsci/special_issues/Brillouin_Scattering_Optomechanics



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FEMTO-ST Institute

The WOMBAT workshop will take place at the FEMTO-ST headquarters at Temis in Besançon:
15B Avenue des Montboucons
25030 Besançon cedex
France

The organising committee is glad to welcome you cordially in Besançon city, and more precisely in the «TEMIS» area.

TEMIS, the Microtechnology and Scientific cluster, is the only technical centre in France dedicated to micro-technological business. On the 130 hectares of the TEMIS site, innovative technological companies work in cooperation with engineering schools, the university laboratories, the training institutions, at the hub of a network of industries and microtechnology suppliers, in a recognised technological environment.

Part of this area, FEMTO-ST is a joint research unit associated with CNRS (French National Centre for Scientific Research) and the University Bourgogne-Franche-Comté, of which the Department of Optics is internationally recognized in the research fields of optoelectronics, optoacoustics and nonlinear photonics.



(c) Jack Varlet

Besançon

Besançon is an old Roman town of Art and History where Vauban's masterpiece (engineer and military architect, XVIIe century), the Citadel belongs to the UNESCO World Heritage. The city is famous for microtechnology and watch industries. It is located in the eastern France near Switzerland border, in the heart of Europe.

INFORMATION

Registration desk

Pre-registered participants or on-site registrants may pick up their conference materials at the registration desk. All delegates will receive a name badge upon arrival. The name badge serves as your entrance ticket to the sessions, please make sure that you wear it at all times during all workshop activities.

Opening hours:

Monday, 3 July 2017: 09:00 - 10:00 am

Tuesday, 4 July & Wednesday 5 July 2017: 8.30 - 9.00 am

Workshop sessions

The tutorial sessions on Monday 3 July, will take place at the FEMTO-ST Institute (15b avenue des Montboucons) from 10:00 to 17:30 pm

The technical sessions on Tuesday 4 July and Wednesday 4 July will take place at FEMTO-ST institute (15b avenue des Montboucons) .

Instructions for oral presentations

Please check the program well in advance for the date and time of your presentation. The organizers will provide all necessary equipment. Presenters will have 15 minutes for their presentation. Please be considerate of other presenters in your session and keep your presentation at or under the 15 minutes allocated.

Presenters are asked to:

Please arrive at the presentation room of your session 10 minutes before the start of the session

Please upload your PowerPoint file onto the laptop in the room for presentation and make sure that your file runs appropriately.

It is recommended to use a standard font like Arial or Times New Roman to create your presentation.

If you wish, you may use your laptop that has a VGA output for the presentation.

Social Events

Workshop reception at Mercure Hotel: Tuesday 4 July at 20:00

Notices and messages

Notices and messages related to workshop activities and any changes to the workshop program will be displayed at the registration desk;

Mobile phones

As a courtesy to other delegates, please ensure that all mobile phones are tuned off or in silent mode during all sessions.

Disclaimer

All details in this handbook are correct at the time of printing. If unavoidable changes are required, we apologize for any inconvenience. The WOMBAT organizing committee, including FEMTO-ST staff, will not accept liability for damages of any nature sustained by participants, or loss of or damage of their property as a result of WOMBAT events.

COMMITTEES

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Sydney

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Mr. Francis Miller
FEMTO-ST

KEYNOTE SPEAKER

Pr. Philip Russell

Max Planck Institute for the Science of Light, Erlangen, Germany



Professor Philip Russell is a founding Director at the Max-Planck Institute for the Science of Light (MPL) and holds the Krupp Chair of Experimental Physics at the University of Erlangen-Nuremberg. He obtained his D.Phil. degree in 1979 at the University of Oxford.

His interests currently focus on scientific applications of photonic crystal fibres. He is a Fellow of the Royal Society and the Optical Society (OSA) and has won a number of awards including the 2000 OSA Joseph Fraunhofer Award/Robert M. Burley Prize, the 2005 Thomas Young Prize of IOP, the 2005 Körber Prize for European Science, the 2013 EPS Prize for Research into the Science of Light, the 2014 Berthold Leibinger Zukunftspreis, the 2015 IEEE Photonics Award and the 2018 Rank Prize for Optoelectronics. He was OSA's President in 2015, the International Year of Light.



MAX-PLANCK-INSTITUT
für die Physik des Lichts

OSA, UFFC, IEEE, SPIE Student Chapter

Created in February 2009 along the FEMTO-ST Institute, the chapter is historically the first OSA student chapter in France and gathers PhD and Master Student. We merged progressively with SPIE, UFFC and IEEE branches, as students belong to quite different domains (mostly from Optics, Micro Nano Sciences and Systems and Time-Frequency Departments).

The association enables the exchange and the spread of knowledge with high level meetings with specialists and professionals of several disciplines. Also, it allows the discovery of the physics world through outreach activities for young students from high schools and general public. To do so we organize and/or participate to a series of events within the institute, but also for more general audience during science spreading events.



Few of our activities:

- Seminars for non-permanents staff,
- Workshops,
- The time fest (24h du Temps),
- Night of researchers,
- Sciences fest,
- Photonics day (co-organized with students from Dijon),
- Scientific trips (CERN...).

Student
chapter

INVITED SPEAKERS

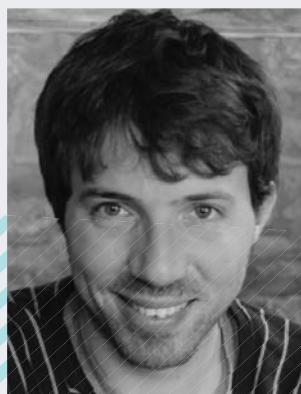


Pr. Luc Thévenaz
Group for Fiber Optics
EPFL, Lausanne, Switzerland

Luc Thévenaz received in 1982 the M.Sc. degree in astrophysics from the Observatory of Geneva, Switzerland, and in 1988 the Ph.D. degree in physics from the University of Geneva, Switzerland. He developed at this moment his field of expertise, i.e. fibre optics.

In 1988 he joined the Swiss Federal Institute of Technology of Lausanne (EPFL) where he currently leads a research group involved in photonics, namely fibre optics and optical sensing.

Research topics include Brillouin-scattering fibre sensors, nonlinear fibre optics, slow & fast light and laser spectroscopy in gases. He is also Fellow of both the IEEE and the Optical Society of America.



Dr. Ivan Favero
Laboratoire Matériaux et Phénomènes
Quantiques,
Université Paris-Diderot, France

After a PhD on semiconductor quantum dots as single photon sources and spin qubits (2005), Ivan Favero carried early research on optomechanical systems at the University of Munich LMU (2005-2008), as postdoctoral scientist. In 2008, he initiated independent research in Paris as CNRS researcher, and coordinated since then several projects on applications of nano-optomechanical systems (including the ERC StG Ganoms). Today a research director at CNRS, his activities go from quantum to nonlinear photonics, and attempt interfacing optomechanics with fluids, collective photonics, imaging and sensing devices, be they operating in the classical or quantum regime.



A/Pr. Amir H Safavi-Naeini
Department of Applied Physics
Stanford University, USA

Amir Safavi-Naeini received his B.A.Sc. in Electrical Engineering at the University of Waterloo in Canada in 2008, spending his work terms at RIM, Altera, and the Institute for Quantum Computing (IQC). He received his Ph.D. in Applied Physics at the California Institute of Technology in 2013 in the group of Oskar Painter working on optomechanical structures and then worked on microwave superconducting qubits in the group of Andreas Wallraff. Since September 2014, Amir has been an Assistant Professor of Applied Physics at Stanford University. He has been awarded the Terman and Hellman fellowships.



Dr. Christian Wolff
University of Technology Sydney
Australia

Christian Wolff studied physics in Karlsruhe (Germany) and completed his PhD in 2011 on photonic crystal band structure theory and numerical method development under the supervision of Prof. Kurt Busch at the Karlsruhe Institute of Technology. There after, he worked at the Max-Born Institute Berlin in association with Humboldt University on the development of higher order accurate numerical methods and nonlinear and nonlocal metal optics. From 2013 to 2017, he was a postdoctoral research associate at the University of Technology, Sydney under the supervision of A/Prof. Christopher Poulton and worked on the theory of Stimulated Brillouin scattering in close collaboration with members of the CUDOS network, especially with Prof. Mike Steel (Macquarie University), Dr. Birgit Stiller, Prof. Martijn de Sterke and Prof. Benjamin Eggleton (University of Sydney). He is currently a postdoctoral researcher with Asger Mortensen at the University of Southern Denmark in Odense.

INVITED SPEAKERS



Dr. Sungkun Hong
University of Vienna, Austria

Dr. Sungkun Hong is a postdoctoral researcher in the group of Prof. Aspelmeyer at the University of Vienna. He earned his PhD in Applied Physics from Harvard University, where he was focused on developing Quantum Sensing technologies based on solid-state electronic spins in diamonds. Since 2013, he has been working on various topics in Quantum Optomechanics using micro-fabricated optomechanical devices. He and his coworkers recently demonstrated the generation of non-classical pairs of single photon and single phonon and heralded single phonons from on-chip silicon structures, which are important milestones in developing on-chip optomechanical quantum circuits. He has co-authored 11 scientific publications in international peer-reviewed journals with around 2000 citations (Google Scholar Citations).



A/Pr. Avi Zadok
Bar-Ilan University, Israel

Avi Zadok received his Ph.D. in Electrical Engineering from Tel-Aviv University, Israel in 2008. In 2007-2009 he was a post-doctoral research fellow with the Department of Applied Physics of the California Institute of Technology (Caltech). He joined the Faculty of Engineering of Bar-Ilan University in Ramat-Gan, Israel in 2009, and was appointed an Associate Professor in 2013. Dr. Zadok's research interests are in fiber-optic sensors, microwave photonics, all-optical signal processing, and photonic devices in silicon and chalcogenide glass. He is a co-author of 120 papers in scientific journals and proceedings of international conferences, and serves in the technical program committees of several conferences in electro-optics. Dr. Zadok received the Krill Award of the Wolf Foundation in 2013, and a Starter Grant from the European Research Council (ERC) in 2015. He is a member of the Israel Young Academy of Science.



Dr. Birgit Stiller
CUDOS, Australia

Birgit Stiller is a Research Fellow at the University of Sydney with focus on photon-phonon interactions in photonics circuits. She received her doctoral degree in Nonlinear Fiber Optics at the CNRS Research Institute FEMTO-ST, Besançon, France where she was working on Brillouin scattering in photonic crystal fibers and fiber sensor applications. From 2012 on, she was a Postdoctoral Fellow at the Max Planck Institute for the Science of Light in Erlangen, Germany, in the quantum optics division of Prof. Gerd Leuchs, focusing on continuous variable quantum key distribution. In 2015, she joined the University of Sydney as a Research Fellow in the Nonlinear Phononics group. Her research interests include nonlinear fiber optics, opto-acoustic interactions in integrated circuits and optical fibers, fiber sensors, as well as quantum communication, specifically quantum key distribution and quantum hacking.



Prof. Thomas Schneider
TU Braunschweig, Germany

Thomas Schneider received the diploma degree in electrical engineering from the Humboldt Universität zu Berlin, Germany, in 1995, and the Ph.D. degree in physics from the Brandenburgische Technische Universität Cottbus, Germany in 2000. From 2000 to 2013 he was a Professor for high frequency technology at the Hochschule für Telekommunikation (HfT) in Leipzig, Germany where he founded and headed the Institut für Hochfrequenztechnik. Since 2013 he has been with the Technische Universität Braunschweig. Dr. Schneider was a guest professor at the Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland, a guest scientist at the Deutsche Telekom Innovation Laboratories and at the Heinrich Hertz Institute, Berlin. His current research interests include applications of stimulated Brillouin scattering, optical signal processing and integrated silicon photonics. Dr. Schneider is the author and co-author of 4 books, more than 160 publications and 30 patents or patent applications.

PROGRAM-AT-A-GLANCE

Monday 03

Registration
9:00 to 10:00

Welcome
10:00 to 10:15

Tutorial 1
Luc Thévenaz
10:15 to 11:00

Short Break

Tutorial 2
Vincent Laude
11:15 to 12:00

Lunch

Tutorial 3
Ivan Favero
14:00 to 14:45

Afternoon Coffee

Tutorial 4
Amir H. Safavi-Naeimi
15:15 to 16:00

Short Break

Key Note
Philip Russell hosted by
OSA/SPIE Student Chapter
16:15 to 17:15

Welcome Reception
& Posters Session
17:30 to 19:30

Social Event
Boat Trip to visit City Center
20:00

Tuesday 04

Registration
8:30 to 9:00

Invited Talk
Christian Wolff
9:00 to 9:30

Session A
SBS/Optomechanics in
Waveguides
09:30 to 10:30

Morning coffee

Invited Talk
Sungkun Hong
11:00 to 11:30

Session B
Quantum Dynamics
11:30 to 12:30

Lunch

Invited Talk
Avi Zadok
14:00 to 14:30

Session C
Applications of Brillouin
scattering I
14:30 to 15:30

Afternoon Coffee

Session D
Applications of Brillouin
scattering II
16:00 to 17:00

Dinner at Mercure Hotel
20:00

Wednesday 05

Registration
8:30 to 9:00

Invited Talk
Birgit Stiller
9:00 to 9:30

Session E
Microwave Photonics
09:30 to 10:30

Morning coffee

Invited Talk
Thomas Schneider
11:00 to 11:30

Session F
SBS Devices
11:30 to 12:30

Lunch

Invited Talk
Kien Phan Huy
14:00 to 14:30

Session G
Unconventional materials
Systems
14:30 to 15:30

Afternoon Coffee

Session H
SBS/Optomechanics in
resonators
16:00 to 17:00

Best Student Presentation
Award sponsored by APL
Photonics
17:15

Monday 03 July

TIME	SESSION
09:00	Registration and Coffee
10:00	WELCOME
10:15	TUTORIAL 1 Distributed fibre sensing using Brillouin scattering: review on progresses Luc Thévenaz, EPFL, Switzerland
11:00	Short Break
11:15	TUTORIAL 2 Modeling of light and sound interaction in nanoscale waveguides and cavities Vincent Laude, FEMTO-ST Institute, France
12:00	Lunch
14:00	TUTORIAL 3 New directions in nano-optomechanics Ivan Favero, Université Paris-Diderot, France
14:45	Short Break
15:00	TUTORIAL 4 Controlling Phonons and Photons on a Chip Amir H. Safavi-Naeini, Stanford University, USA
15:45	Afternoon Coffee
16:15 - 17:15	KEY NOTE: Phonons, photons and fibre nanostructures Philip Russell, Max Planck Institute, Germany hosted by OSA/SPIE Student Chapter
17:30	Welcome Reception & Posters Session
20:00	Boat Trip to visit City Center

Tuesday 04 July

TIME	SESSION
08:30	Registration and Coffee
09:00	SBS/Optomechanics in waveguides
09:00	INVITED TALK Coming to terms with Brillouin Scattering in Nano-Structured Waveguides Christian Wolff, University of Technology Sydney, Australia
09:30	Towards Strong Coupling in Silicon Optomechanical Waveguides Raphaël Van Laer, Stanford University, USA
09:45	High-efficiency Integrated Photonic-Phononic Emit-Receiver Eric A. Kittlaus, Yale University, USA
10:00	Brillouin Scattering Self-Cancellation in Silica Nanowires Paulo Dainese, University of Campinas, Brazil
10:15	NumBAT - The Numerical Brillouin Analysis Tool Michaël Steel, Macquarie University, Australia
10:30	Morning Coffee
11:00	Quantum Dynamics
11:00	INVITED TALK Towards an On-chip Optomechanical Quantum Interface Sungkun Hong, University of Vienna, Austria
11:30	Beyond the Phononic Fabry-Perot Resonator: Confinement of Acoustic Phonons in Spacerless Cavities Martin Esmann, C2N, France
11:45	Bulk Crystalline Phonon Resonator Optomechanics William H. Renninger, Yale University, USA
12:00	Exploring the limits of phonon dissipation in silicon at cryogenic temperatures Prashanta Kharel, Yale University, USA
12:15	Canonical impulsion of individual Brillouin phonons Eric Picholle, Université Nice Sophia Antipolis, France
12:30	Lunch



TIME	SESSION
14:00	Applications of Brillouin scattering I
14:00	INVITED TALK Sensing outside of standard fibers using guided acoustic wave Brillouin scattering Avi Zadok, Bar-Ilan University, Israel
14:30	The beauty of DTSS with Brillouin Etienne Rochat, Omnisens, Switzerland
14:45	Metrology of optical microwires by Brillouin spectroscopy Adrien Godet, FEMTO-ST, France
15:00	Locating Auxiliary Elastic Resonances in Silica Microwires Desmond Chow, EPFL, Switzerland
15:15	Sub-mm spatial resolution BOCDA measurement of a photonic integrated circuit Atiyeh Zarifi, CUDOS, Australia
15:30	Afternoon Coffee
16:00	Applications of Brillouin scattering II
16:00	Guided Acoustic Waves Brillouin Scattering in Multi-Core Fibers Hilel Hagai Diamandi, Bar Ilan Univerity, Israël
16:15	Towards a Brillouin laser in silicon Nils T. Otterstrom, Yale University, USA
16:30	On-chip Brillouin signal processing for high-capacity optical communications Amol Choudhary, CUDOS, Australia
16:45	Tunable CS-SSB instrumentation for Brillouin applications Jérôme Hauden, iXBlue, France
20:00	Dinner at Mercure Hotel

Wednesday 05 July

TIME	SESSION
08:30	Registration and Coffee
09:00	Microwave Photonics
09:00	INVITED TALK Coherent on-chip photonic-phononic memory Birgit Stiller, CUDOS, Australia
09:30	Electro-opto-mechanical radio-frequency oscillator in standard fiber Yosef London, Bar Ilan University, Israël
09:45	Modulation of coherent phonon emission in optomechanical photonic crystals Jérémie Maire, ICN2, Spain
10:00	Observation of Fano-like line shapes in RF domain using backward stimulated Brillouin scattering Siva Shakthi, Indian Institute of Science Education and Research, India
10:15	Integrated opto-mechanical crystal with surface acoustic waves transducers Rui Zhu, C2N, France
10:30	Morning Coffee
11:00	SBS Devices
11:00	INVITED TALK Bandwidth reduction of stimulated Brillouin scattering and its applications Thomas Schneider, TU Braunschweig, Germany
11:30	Femtosecond heterodyne pump-probe set-up: characterization of the anisotropic propagation of surface elastic waves Etienne Coffy, FEMTO-ST, France
11:45	Noise Characterization of a Broadband Fiber Brillouin Amplifier Yves Jaouen, Télécom ParisTech, France
12:00	Brillouin devices through hybrid integration on Silicon Blair Morrison, CUDOS, Australia
12:15	Stimulated Brillouin scattering based fluorides whispering gallery mode resonators Souleymane Diallo, FEMTO-ST Institute, France
12:30	Lunch



TIME	SESSION
14:00	Unconventional materials systems
14:00	INVITED TALK Towards the control of an acoustic wave by Brillouin scattering Kien Phan Huy, FEMTO-ST Institute, France
14:30	Surface Plasmon Enhanced Forward Stimulated Brillouin Scattering: A method for Sub-terahertz Phonon Generation Qiang Liu, Shenzhen University, China
14:45	Stimulated Brillouin Scattering in plasmonic waveguides Chris Poulton, University of Technology Sydney, Australia
15:00	Piezo-optomechanical nonreciprocal modulator Donggyu Sohn, University of Illinois, USA
15:15	Doubly-resonant metal ridge array for enhanced acousto-optical modulation Fadi Baida, FEMTO-ST, France
15:30	Afternoon Coffee
16:00	SBS/Optomechanics in resonators
16:00	Optomechanics Beyond the Few GHz Range in GaAs/AlAs Micropillars Fabrice Roland Lamberti, C2N, France
16:15	Optomechanical cavity design with a complete phononic bandgap for a confined 5 GHz acoustic mode Laura Mercadé Morales, Universitat Politècnica de València, Spain
16:30	Anderson localization to mediate the optomechanical coupling at the nanoscale Guillermo Arregui, ICN2, Spain
16:45	Brillouin Optomechanics in Coupled Silicon Microcavities Gustavo Wiederhecker, University of Campinas, Brazil
17:15	Best Student Presentation AWARD, sponsored by APL Photonics
17:30	Farewell address