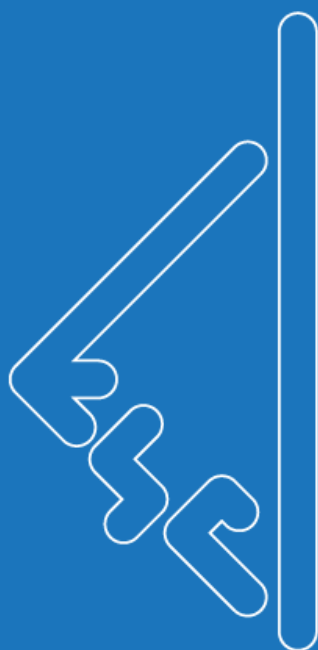


2019

23 Sept
27 Sept



**INSTITUT
D'ÉTUDES
SCIENTIFIQUES
DE CARGÈSE**



Direction scientifique :
Fabrice Mortessagne

Contact :
Dominique Donzella
tél : 04 95 26 80 40

www.iesc.univ-corse.fr

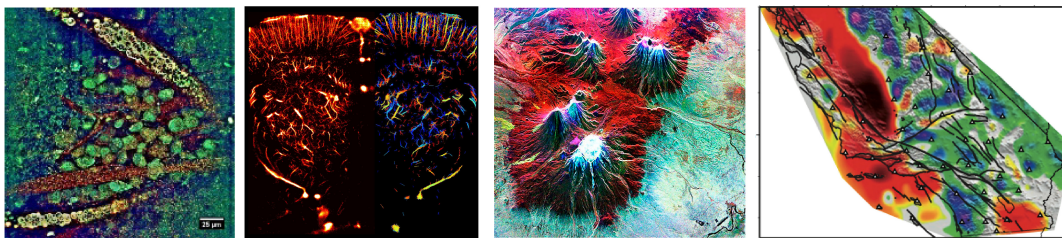
IMAGING IN WAVE PHYSICS: MULTI-WAVE AND LARGE SENSOR NETWORK

**Mathias FINK
Alexandre AUBRY
Romain PIERRAT
Sbastien POPOFF
Institut Langevin ESPCI
Paris FR**





Cargèse International School 2019
Imaging in Wave Physics
Multi-Wave and Large Sensor Networks



School director

Pr. Mathias Fink

Scientific and organizing committee

Dr. A. Aubry, Dr. R. Pierrat, Dr. S. Popoff

Contact

Cargèse Summer School

Institut Langevin

1 rue Jussieu

75005 Paris, France

cargese@espci.fr



Institut Langevin
ONDES ET IMAGES



Contrôle
des Ondes
en Milieu
comPLEXE





Cargèse International School 2019

Imaging in Wave Physics Multi-Wave and Large Sensor Networks

School scope

Whatever the nature of the waves used (acoustic, electromagnetic, seismic or optical) and propagation media, wave control is of fundamental interest for many applications ranging from live imaging to telecommunications including medical diagnosis or defense. The emergence of large-scale sensor arrays in each of these disciplines and recent advances in data science will revolutionize imaging in the coming years. It is therefore the moment to bring these physical and mathematical concepts related to imaging into a summer school. The goal is to share knowledge and experiences in areas that have different applications but have very similar issues.

The school will consist of lectures given by eminent scientists and seminars to present recent works and applications. This format will allow attendees to appropriate the common theoretical bases of wave physics in complex environments and data processing, while having a very good overview of the different experimental approaches specific to each type of wave. This multi-disciplinary approach will also allow junior and senior researchers to go beyond the scope of their own research topics, and to acquire an overall vision necessary for cutting-edge research. A specific effort will be made to target the younger audience. It will allow PhD students and young scientist to acquire a solid and broad knowledge of imaging in complex media from the best experts worldwide.

1 Practical information

1.1 Arrival

For those arriving on Sunday 22nd, bus transportation will be organized from Ajaccio airport to Cargèse. A person with a school poster will wait for you at the exit of the luggage area. The bus meeting point is also indicated in Fig. 1.

- First bus departure just after the flight landing at **15:20**.
- Second bus departure just after the flight landing at **17:45**.

The buses will first drop the participants accommodated at the Helios residence and at the Institute, and then move to Place Saint-Jean in Cargèse where the remaining participants will be guided to their housing place.

Participants arriving by their own vehicle should go to the Institute or to Place Saint-Jean depending on their accommodation place indicated in Sec. 3. For people accommodated in a hotel or in the Helios residence, you can go there directly. In case you arrive late in Cargèse, beware that it is difficult to find shops or restaurants open to eat in the village.

1.2 Location of the lectures and seminars

Lectures, seminars, coffee breaks, lunches and the poster session will take place at the Institut d'Études Scientifiques de Cargèse, which is distant of about 1.7 km from the Cargèse village. The route between the institute and the village can be done by foot (20-minute walk, see Fig. 2). The welcome drink (Monday evening) as well as the barbecue dinner (Thursday evening) will also take place at the Institute.

1.3 Housing

Housing is provided from Sunday night (September 22nd) to Saturday morning (September 28th). Your housing place is indicated in the list of participants in Sec. 3. There are five types of housing:

- (A) Apartments in the village or nearby;
- (H) Hotels, located in the village (see map in Fig. 3);
- (I) Single or double rooms at the institute;
- (R) Helios residence (<http://www.locations-corse-cargese.com/>);
- (V) Villa.

1.4 Lunches and dinners

Lunches will take place at the Institute, they are included in the conference fees. A barbecue dinner is also organized at the Institute on Thursday evening. Other dinners are at the own

expense of the participants. Many nice restaurants can be found in the village or around (20-minute walk from the Institute).

1.5 Contact information in case of any problem

- Alexandre Aubry 📞 +33 6 49 52 64 13
- Romain Pierrat 📞 +33 6 86 93 77 77
- Sébastien Popoff 📞 +33 6 95 94 93 48

1.6 Maps

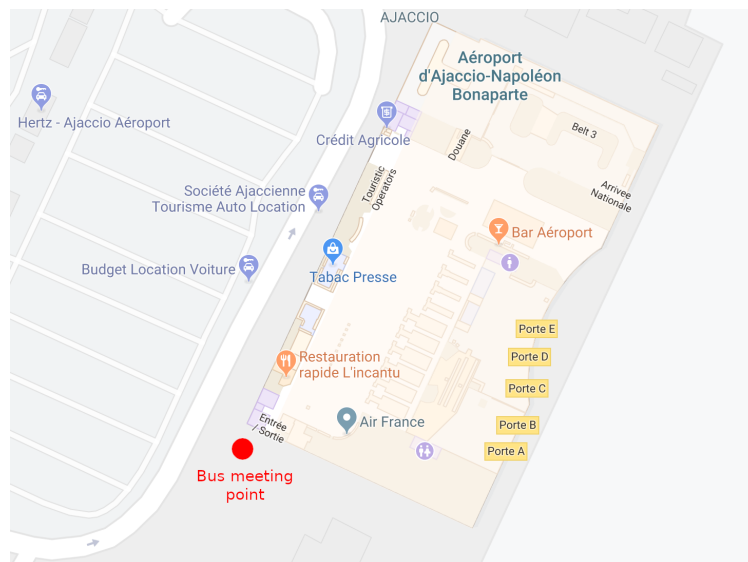


Figure 1 – Ajaccio airport map and bus meeting point

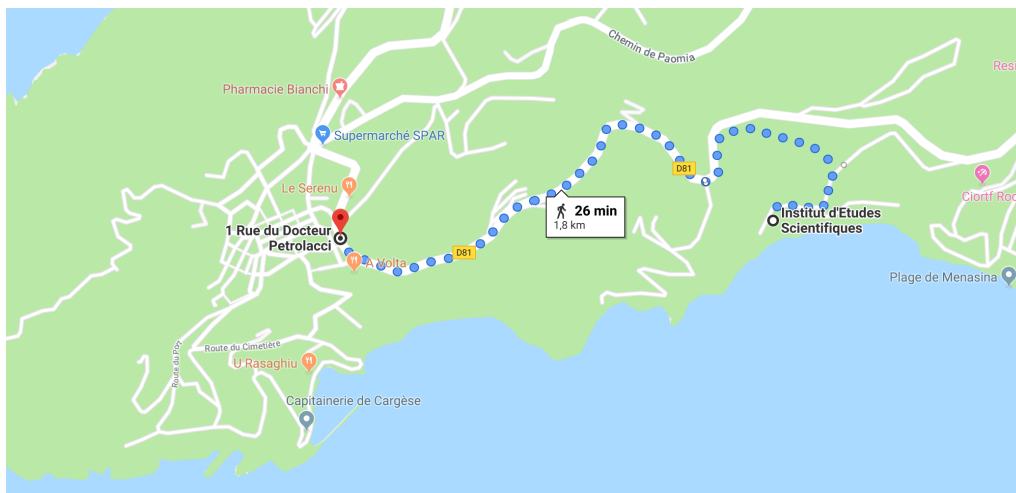


Figure 2 – Route from the village of Cargèse to the Institut d'Études Scientifiques

2 Program

2.1 Overview

	Monday	Tuesday	Wednesday	Thursday	Friday
8h30	Mathias Fink	Geoffroy Lerosey	Michel Campillo	Josselin Garnier	Ulugbek Kamilov
10h00	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
10h30	Frédéric Barbaresco	Jérôme Mertz	Emmanuel Bossy	Vincent Lepetit	Kees Wapenaar
12h00	Lunch	Lunch	Lunch	Lunch	Lunch
13h30	Discussions & Beach	Discussions & Beach	Poster session with beers and coffee	Discussions & Beach	Sophie Brasselet
14h30					Julien de Rosny
15h00	Tomas Čižmár	Antonin Eddi		Alexandre Aubry	
15h30	Coffee break	Coffee break		Coffee break	
16h00	Ori Katz	Wonshik Choi		Changhuei Yang	
16h30	Welcome drink	Olivier Couture	Stefan Catheline	Student's talks	
17h30			Emmanuel Fort (public lecture, in french)	Dinner	
18h00					
18h30					
19h00					
19h30					
20h00					
22h00					

■ Courses ■ Seminars

2.2 Courses

- **From time-reversal to matrix imaging**
Pr. Mathias Fink – ESPCI Paris
- **The digital radar**
Mr. Frédéric Barbaresco – Thales

- **Speckle imaging**
Dr. Ori Katz – The Hebrew University of Jerusalem
- **Wavefront shaping for microwaves**
Dr. Geoffroy Lerosey – Greenerwave
- **Volumetric imaging in scattering media**
Pr. Jérôme Mertz – Boston University
- **Seismic imaging**
Pr. Michel Campillo – Université de Grenoble
- **Multi-wave imaging**
Pr. Emmanuel Bossy – Université de Grenoble
- **Recent mathematical developments for imaging**
Pr. Josselin Garnier – École Polytechnique
- **Deep learning**
Pr. Vincent Lepetit – Université de Bordeaux
- **Computational imaging**
Dr. Ulugbek Kamilov – Washington University in St. Louis
- **Green's theorem in imaging across the scales**
Pr. Kees Wapenaar – Delft University of Technology

2.3 Seminars

- **Imaging through multimode fibers**
Pr. Tomas Čižmár – Leibniz Institute of Photonic Technology
- **Control and manipulation of hydroelastic waves**
Dr. Antonin Eddi – ESPCI Paris
- **Deep optical imaging**
Pr. Wonshik Choi – Korea University
- **Ultrasound localization microscopy**
Dr. Olivier Couture – Physics for Medicine, Paris
- **Multi-wave imaging of elasticity**
Dr. Stefan Catheline – Université de Lyon 1
- **Matrix approach of wave imaging in complex media**
Dr. Alexandre Aubry – ESPCI Paris
- **Applications of wavefront shaping**
Pr. Changhuei Yang – Caltech
- **Non-linear microscopy**
Dr. Sophie Brasselet – Institut Fresnel
- **Passive imaging**
Dr. Julien de Rosny – ESPCI Paris

2.4 Student's talks

- **An Artificial Neural Network with Physical Dynamic Metasurface Layer for Optimal Sensing**
P. del Hougne, M. F. Imani, A. V. Diebold, R. Horstmeyer and D. R. Smith

- **Mesoscopic wave physics in a dense fish school**
B. Tallon, P. Roux, G. Matte, J. Guillard and S. Skipetrov
- **Readout of fluorescence functional signals through highly scattering tissue**
C. Moretti and S. Gigan

2.5 Posters

- **Acousto-optic tomography beyond the acoustic diffraction-limit**
M. Rosenfeld
- **Measuring the TM of scattering medium using reflected fluorescent light**
E. Premillieu and R. Piestun
- **Transdimensional seismic imaging**
A. Rahimi Dalkhani, C. Weemstra and K. Wapenaar
- **Acousto-optic tomography beyond the acoustic diffraction-limit using speckle decorrelation**
M. Rosenfeld, D. Doktovsky and O. Katz
- **Wide-field laser scanning microscopy for imaging intact skull**
H. Lee, S. Yoon, J. Hee Hong and W. Choi
- **Fluorescent and photoacoustic imaging by wavefront shaping through a multimode fibre**
S. Mezil, T. Remark, A. M. Caravaca-Aguirre, P. Moreau, I. Wang and E. Bossy
- **Optimal Wave Fields for Micro-manipulation in Complex Scattering Environments**
M. Horodynski, M. Kühmayer, A. Brandstötter, K. Pichler, Y. Fyodorov, U. Kuhl and S. Rotter
- **Coherent Control of Light Transport in Disordered Media**
N. Bender, H. Yilmaz, A. Yamilov and H. Cao
- **Creating and Controlling Complex Light**
N. Bender, H. Yilmaz, Y. Bromberg and H. Cao
- **Photoacoustic imaging of the meniscus vasculature in the knee joint**
B. Rivière, O. Jacquin, O. Hugon, B. Van Der Sanden, B. Arnal and E. Lacot
- **Increased field-of-view Full-Field OCT for 3D high-resolution retinal imaging**
P. Mecê, K. Groux, J. Scholler, M. Fink, K. Grieve and C. Boccara
- **3D super-resolution model based-method for photoacoustics**
G. Godefroy, S. Vilov, B. Arnal and E. Bossy
- **Comparing the ptychographical iterative engine to an optimization framework based on automatic differentiation**
J. Seifert, D. Bouchet and A. P. Mosk
- **Label-free deep-tissue imaging in vivo using adaptive optical synchronous angular scanning microscopy**
Y. Jo, M. Kim, J. Hee Hong, S. Yoon, S. Kang and W. Choi
- **Toward photoacoustic imaging in bone**
J. Shepherd, G. Renaud, K. van Wijk
- **Non-conventional multimodal microendoscopy**
M. Caravaca-Aguirre, S. Singh, S. Labouesse, R. Piestun and E. Bossy
- **Multi-element ultrasonic evaluation of scattering solids by reflection matrix analysis**
C. Brütt, B. Gérardin, A. Aubry, A. Derode and C. Prada
- **Matrix approach of ultrasound imaging and quantification**
W. Lambert, L. Cobus, M. Fink and A. Aubry

- **Tunable metamaterial-based antennas for magnetic resonance imaging**
A. Nikulin, J. de Rosny, K. Haliot, B. Larrat and A. Ourir
- **Non-invasive light focusing in scattering media using speckle variance optimization**
A. Boniface, B. Blochet, J. Dong and S. Gigan
- **Cross-correlation induced interferences in the diffusely scattered light from combined surface and volume disorders**
J.-P. Banon, R. Pierrat, R. Carminati and I. Simonsen
- **Space-time transformation with water waves: from time-reversed mirrors to lenses**
S. Wildeman, V. Bacot, G. Durey, M. Labousse, A. Eddi, M. Fink and E. Fort
- **Computing with coupled water wave sources**
S. Sreenivas, S. Wildeman, A. Eddi and E. Fort
- **Complex Media as Universal Linear Operators**
M. W. Matthès, P. del Hougne, G. Lerosey, J. de Rosny and S. M. Popoff
- **Acousto-Optic Transmission Matrices**
F. Ramaz, S. Popoff, M. Bocoum and L. Dutheil
- **Advances in Microendoscopy Through a Multimode Optical Fiber**
A. Cifuentes, T. Pikálek, J. Traegaardh, P. Jakl, M. Šiler, S. Simpson, H. Štolzová, H. Uhlířová, T. Tučková and T. Čižmár
- **Collective modes of hyperuniform resonant media**
R. Monsarrat, R. Carminati, A. Tourin, R. Pierrat and A. Goetschy
- **Passive Reflection Seismic Imaging of the San Jacinto Fault Zone, California: A Matrix Framework for Aberrations Correction**
R. Touma, T. Blondel, A. Lecointre, A. Derode, M. Campillo and A. Aubry
- **Non-invasive brain palpation using Magnetic Resonance Passive Elastography**
K. Rachid, S. Catheline, B. Giammarinaro, F. Mauconduit, A. Vignaud and J.-L. Gennisson
- **3D ultrasound and photoacoustic imaging of chicken embryo vasculature**
G. Godefroy, B. Arnal, S. Vilov and E. Bossy
- **Optimizing light storage in scattering media with the dwell-time operator**
M. Durand, S. M. Popoff, R. Carminati and A. Goetschy
- **Suppressing Spatial Coherence with Spatiotemporal Optical Coherence Manipulation (STOC)**
P. Wegrzyn, D. Borycki and M. Wojtkowski
- **Phase Retrieved Tomography for Alignment-free 3D Optical Imaging**
D. Ancora, D. Di Battista, G. Giasafaki, S. E. Psycharakis, E. Liapis, J. Ripoll and G. Zacharakis

3 Participants

Surname	Firstname	Affiliation	Transfer	Housing
Alverède	Simon	Institut Jean Le Rond d'Alembert, Sorbonne Université - CNRS, Paris, France	E	I
Ancora	Daniele	Politecnico Di Milano - Department of Physics	E	R
Apffel	Benjamin	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Aubry	Alexandre	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Balondrade	Paul	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Banon	Jean-Philippe	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I

Surname	Firstname	Affiliation	Transfer	Housing
Baraçal de Mecê	Pedro	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Barbaresco	Frédéric	Thales	E	I
Bender	Nicholas	Cao Lab, Yale University, New Haven, USA	E	A
Bendjador	Hanna	Physics for Medicine Paris Inserm, ESPCI Paris, CNRS, PSL Research University	E	A
Boccara	Claude	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	V
Bocoum	Maïmouna	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Boniface	Antoine	Laboratoire Kastler-Brossel, ENS Paris - CNRS, Paris, France	E	A
Bossy	Emmanuel	LIPhy, CNRS - Grenoble Alpes University, Grenoble, France	E	I
Brandstötter	Andre	Institute for Theoretical Physics, Vienna University of Technology, Vienna, Austria	T	I
Brasselet	Sophie	Institut Fresnel, CNRS - Aix-Marseille Université, Marseille, France	T	I
Brütt	Cécile	Institut Langevin, ESPCI Paris, CNRS - Safran, Paris, France	E	A
Bureau	Flavien	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Cailly	William	LMA, CNRS - Centrale Marseille - Aix-Marseille Université, Marseille, France	O	I
Campillo	Michel	ISTerre, Université Grenoble Alpes - CNRS, Grenoble, France	T	H
Caravaca Aguirre	Antonio Miguel	LIPhy, CNRS - Grenoble Alpes University, Grenoble, France	O	I
Catheline	Stefan	Université de Lyon 1	O	H
Chaigne	Thomas	Institut Fresnel, CNRS - Aix-Marseille Université, Marseille, France	O	I
Choi	Wonshik	Center for Molecular Spectroscopy and Dynamics, Institute for Basic Science, Seoul, South Korea	T	H
Cifuentes	Angel	Institute of Scientific Instruments, Czech Academy of Sciences, Brno, Czech Republic	E	I
Cizmar	Tomas	Leibniz Institute of Photonic Technology, Jena, Germany / Institute of Scientific Instruments, Czech Academy of Sciences, Brno, Czech Republic	O	R
Couture	Olivier	Physics for medicine, Paris	E	I
de Rosny	Julien	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	H
del Hougne	Philipp	INPHYNI, Université Côte d'Azur - CNRS, Nice, France	T	I
Du Moulinet d'Hardemare	Guillaume	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Dutheil	Louis	Institut Langevin, ESPCI Paris - CNRS, Paris, France	O	A
Eddi	Antonin	Laboratoire PMMH - UMR 7636	E	I
Fink	Mathias	Institut Langevin, ESPCI Paris - CNRS, Paris, France	O	V
Fort	Emmanuel	Institut Langevin, ESPCI Paris - CNRS, Paris, France	T	H
Garnier	Josselin	Centre de Mathématiques Appliquées, École Polytechnique, Palaiseau, France	E	H
Gennisson	Jean-Luc	BioMaps. CNRS - Université Paris-Saclay, Orsay, France	O	I
Godefroy	Guillaume	LIPhy, CNRS - Grenoble Alpes University, Grenoble, France	E	I
Goetschy	Arthur	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Goldfriend	Nir	Advanced Imaging Lab, Department of Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel	T	A
Gros	Jean-Baptiste	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Groux	Kassandra	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Guediche	Amira	CEA Le Ripault, CEA, Monts, France	E	I
Guilbert	Julien	Laboratoire Kastler-Brossel, ENS Paris - CNRS, Paris, France	E	A
Harry Penketh	Harry	University of Exeter, Exeter, United Kingdom	E	I

Surname	Firstname	Affiliation	Transfer	Housing
Kamilov	Ulugbek	Computational Imaging Group , Washington University in St. Louis, St. Louis, USA	T	H
Katz	Ori	Advanced Imaging Lab, Department of Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel	E	I
Lambert	William	Institut Langevin, ESPCI Paris - CNRS, Paris, France	O	A
Laroche	Nans	LS2N, Université de Nantes - CNRS, Nantes, France / The Phased Array Company, West Chester, USA	E	A
Lee	Hojun	Center for Molecular Spectroscopy and Dynamics, Institute for Basic Science, Seoul, South Korea	T	I
Lennon	Rachel Ann	University of Exeter, Exeter, United Kingdom	E	I
Lepetit	Vincent	LaBRI, Université de Bordeaux, Bordeaux, France	T	H
Lerosey	Geoffroy	Greenerwave, Paris, France	T	H
Lo	Mor Diama	Institut d'Électronique et de Télécommunications de Rennes, University Rennes 1, Rennes, France	E	A
Safadi	Mamoon	Complex Photonics Lab, Racah Institute of Physics, Hebrew University of Jerusalem, Jerusalem, Israel	E	A
Matthes	Maxime	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Mertz	Jérôme	Biocmicroscopy Lab, Boston University, Boston, USA	E	H
Mezil	Sylvain	LIPhy, CNRS - Grenoble Alpes University, Grenoble, France	O	I
Monsarrat	Romain	Institut Langevin, ESPCI Paris - CNRS, Paris, France	O	A
Moretti	Claudio	Laboratoire Kastler-Brossel, ENS Paris - CNRS, Paris, France	E	I
Najar	Ulysse	Institut Langevin, ESPCI Paris - CNRS, Paris, France	O	A
Nikulin	Anton	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Paulavičius	Jonas	Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom	E	I
Pierrat	Romain	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Wegrzyn	Piotr	Institute of Experimental Physics, Institute of Physical Chemistry PAS, University of Warsaw, Warsaw, Poland	E	A
Poncelet	Olivier	Institut de Mécanique et d'Ingénierie, University of Bordeaux - CNRS, Talence, France	O	R
Popoff	Sébastien	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Prada	Claire	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Premillieu	Evolene	University of Colorado at Boulder, Boulder, USA	E	A
Rachid	Khalil	IR4M, Université Paris-Sud - CNRS - Université Paris-Saclay, Orsay, France	O	I
Rahimi Dalkhani	Amin	PhD Student Department of Geoscience and Engineering Delft University of Technology	E	R
Rauer	Bernhard	Laboratoire Kastler-Brossel, ENS Paris - CNRS, Paris, France	E	I
Rivière	Bathilde	LIPhy, CNRS - Grenoble Alpes University, Grenoble, France	E	I
Rosenfeld	Moriya	Photonic Devices Lab, Racah Institute of Physics, Hebrew University of Jerusalem, Jerusalem, Israel	T	A
Roubaud	Gauthier	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Scholler	Jules	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	A
Seifert	Jacob	Nanophotonics Group, Utrecht University, Utrecht, Netherlands	E	A
Shepherd (Johnson)	Jami	Physical Acoustics Lab, University of Auckland, Auckland, New Zealand	E	A
Shirkovskiy	Pavel	Institut Langevin, ESPCI Paris - CNRS, Paris, France	E	I
Shoja	Seyed Mohammad Aydin	Department of Geoscience and Engineering, Delft University of Technology, Delft, Netherlands	E	A
Slobodkin	Yevgeny	Advanced Imaging Lab, Department of Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel	O	I

Surname	Firstname	Affiliation	Transfer	Housing
Sommer	Tal	Advanced Imaging Lab, Department of Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel	T	A
Tallon	Benoit	ISTerre, Université Grenoble Alpes – CNRS, Grenoble, France	O	R
Touma	Rita	ISTerre, Université Grenoble Alpes – CNRS, Grenoble, France	O	A
Vallée	Jean-Christophe	CEA Cadarache, CEA, Saint-Paul-lez-Durance, France / LMA, CNRS - Centrale Marseille - Aix-Marseille Université, Marseille, France	O	I
Wang	Irène	LIPhy, CNRS - Grenoble Alpes University, Grenoble, France	E	I
Wapenaar	Kees	Department of Geoscience and Engineering, Delft University of Technology, Delft, Netherlands	T	H
Yang	Changhuei	Biophotonics Laboratory, Caltech, Pasadena, USA	T	H
Yonghyeon	Jo	Center for Molecular Spectroscopy and Dynamics, Institute for Basic Science, Seoul, South Korea	T	I
Zhipeng	Eric	The Hong Kong Polytechnic University, Hong Kong	E	A

Transfer E: Bus, T: Taxi, O: Other

Housing A: Flat in the village, H: Hotel, I: Institute, R: Helios residence, V: Villa