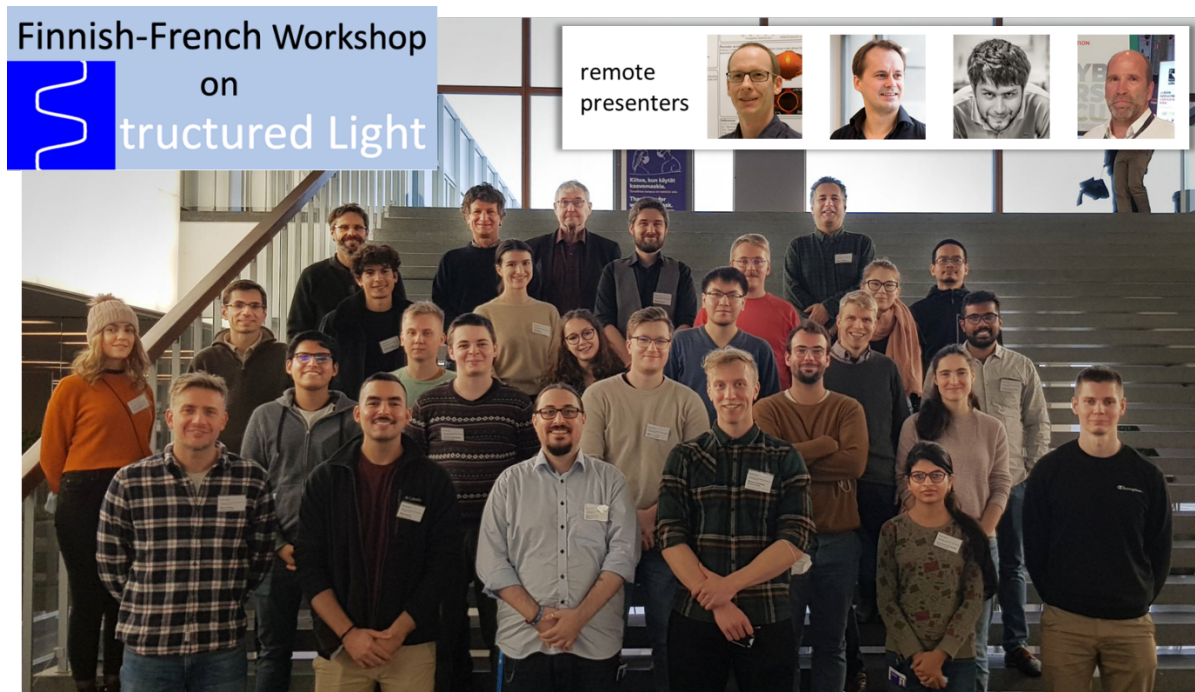


Finnish-French Workshop on Structured Light and its Application Activity Report

The first “Finnish-French Workshop (FFW) on Structured Light and its Applications” took place in Tampere on 3-5 November 2021. It was held at the city centre campus of Tampere University, which was an excellent venue for this event. Many of the main research groups working on this topic within both countries were able to participate and discuss about research and educational collaborations, as well as about interactions with the industrial world. In addition to oral presentations by members of each group, the event also included poster sessions, group discussions, and social events that were essential to cement connections between the participants. The number of participating groups was kept small so that each person could interact with all others. Most participants attended in person (this being their first in-person scientific event in two years!), but those that were unable could give their presentation and attend the others via zoom. In addition to the remote presenters, there were on average 5-10 interested researchers and students from both participating countries joining remotely to listen to the presentations. Below is a group picture taken during the final day of the workshop, followed by a list of in-person participants and remote presenters. In the list, the lead researchers for each group are indicated in blue (with a link to their institutional website).



Finland

Tampere University

[Prof. Robert Fickler](#)

Subjait Bej (postdoc)

Rafael Barros (postdoc)

Lea Kopf (PhD student)

Markus Hiekkamäki (PhD student)

Oussama Korichi (PhD student)

Matias Eriksson (Master student)

[Prof. Marco Ornigotti](#)

Matias Koivurova (postdoc)

Yaraslau Tamashevich (PhD student)

Arttu Nieminen (Master student)

[Dr. Godofredo Bautista](#)

Shambhavee Annurakshita (PhD student)

Leevi Kallioniemi (Master student)

[Dr. Regina Gumenyuk](#)

Iuliia Zaleskaia (PhD student)

[Prof. Goëry Genty](#), (remote) Director of [PREIN](#)

Aalto University

[Dr. Andrei Shevchenko](#)

Panu Hildén (PhD student)

Elena Ilina (PhD student)

University of Eastern Finland

[Prof. Ari Friberg](#)

Jyrki Laatikainen (PhD student)

Aleksi Leinonen (PhD student)

France

Université de Bordeaux

Laboratoire Ondes et Matière d'Aquitaine

[Dr. Etienne Brasselet](#)

Samlan Chandran Thodika (PhD student)

Université de Paris

Saint-Peres Paris Institute for the Neurosciences

[Prof. Marc Guillon](#)

Tengfei Wu (Postdoc)

Baptiste Blochet (Postdoc)

Payvand Arjmand (PhD student)

Ecole Centrale de Marseille

Institut Fresnel

[Prof. Miguel A. Alonso](#)

Isael Herrera Hernandez (PhD student)

Thibault Adelain (Eng. Student)

Edith Hartmann (Eng. Student)

Université Bourgogne Franche-Comté

Femto-ST

[Dr. François Courvoisier](#) (remote)

[Cailabs](#) (industrial participant)

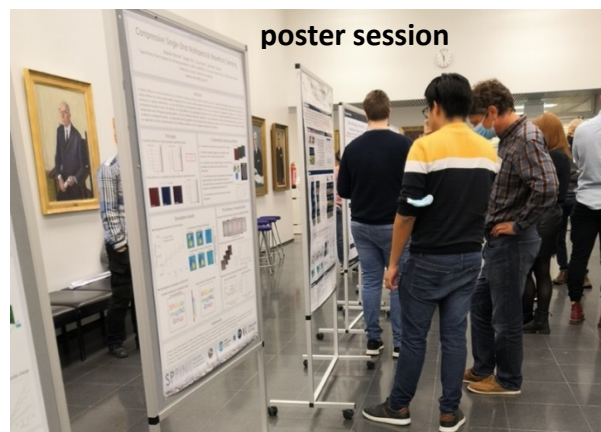
Dr. Pierre Vernaz Gris (remote)

Dr. Arnaud Rigny (remote)

The topic of FFW was “structured light”, which is the study of the tailoring of light to convey to it an interesting and/or desirable structure in space and/or time. Structured light has been the subject of an extensive and extraordinary research effort during the last decades, following the invention of the laser in 1960. This work has resulted in many stunning applications, such as optical tweezers for manipulating cells and particles with light, optical guiding of atoms, novel imaging techniques, light carrying orbital angular momentum, laser material processing (such as welding, cutting, and drilling), and several others in different fields of photonics, and, more generally, applied physics. In addition, the field of structured light has also been applied in the quantum optics domain, where structure is used as a quantum information carrier. Although much seems to have been already achieved, this is but the tip of the iceberg, as this research field still offers enormous possibilities to find new applications and fundamental discoveries. At the workshop, the latest developments of the participating groups were presented and discussed with the intention of serving as a seed for future collaborations and joint projects.

Specific research topics discussed during FFW included:

- the spatial and temporal tailoring of the shape of light beams,
- the properties of light near interfaces with metals,
- applications in microscopy and other forms of imaging,
- applications in laser cutting and material processing,
- manipulation and control of light with novel materials such as graphene or liquid crystals,
- quantum properties of light and their use in information processing and computation,
- fundamental properties of quantum states of structured light,
- the use of artificial intelligence to model the propagation and structuring of light.



Additionally, there were group discussions on industrial collaboration, which included two representatives from a French company, Cailabs, that specializes precisely in applications of structured light. Here, possible joint funding applications as well as different ways of collaborating were discussed. Finally, the participants from both countries shared their experiences on how to collaborate also on the educational side. Different possible avenues to foster joint education programs, e.g. to establish a cotutelle program, were outlined, which can be seen as a promising step towards a closer overall collaboration.

We believe that FFW achieved its goal of not only strengthening existing connections, but of creating a new scientific network of Finnish and French research groups. The strengthened network will enable new collaborations as well as kick-start the search for joint sources of funding for research and educational activities. Moreover, FFW also allowed Engineering, Master, and PhD students as well as young postdocs to expand their network and be exposed to novel possible avenues for their future research career.

The program for FFW was the following:

FRENCH-FINNISH WORKSHOP ON STRUCTURED LIGHT AND ITS APPLICATIONS WORKSHOP PROGRAMME	
Wednesday 03.11.2021	
9:45-10:00	Opening and Welcome
10:00-10:45	Tailoring and/or measuring intensity, coherence and polarisation (Miguel Alonso)
10:45-11:15	Coffee Break
11:15-12:00	Structuring light: spatio-temporal modulation approaches (Etienne Brasselet)
12:00-13:30	Lunch Break
13:30-14:15	Nondiverging multifrequency optical beams with adjustable local group velocities (Andriy Sevchenko)
14:15-15:00	Application of multi-plane conversion to beam shaping and stabilisation (Cailabs)
15:00-15:30	Coffee Break
15:30-16:15	Discussion on Industrial Collaborations
16:15-17:00	
17:00-19:00	Poster Session
Thursday, 04.11.2021	
9:15-10:00	Structuring the nonlinear response of 2D materials via artificial gauge fields (Marco Ornigotti)
10:00-10:45	Self-focusing OAM beams in turbulence (Matias Koivuova)
10:45-11:15	Coffee Break
11:15-12:00	Partially coherent surface plasmon polariton fields (Ari Friberg)
12:00-13:30	Lunch Break
13:30-14:15	Polarization vortex-driven nonlinear optical effects in advanced nano-objects (Godofredo Bautista)
14:15-15:00	Structured illumination applied to ultrafast imaging (Francois Courvoisier)
15:00-15:30	Coffee Break
15:30-16:15	Random light for 3D fluorescence microscopy and multiplexed phase imaging (Marc Guillon)
16:15-17:00	
17:00-17:45	Poster Session
19:00-21:00	Conference Dinner
Friday, 05.11.2021	
9:15-10:00	Photonic Implementations of a Multi-Qubit Quantum Finite Automata (Robert Fickler)
10:00-10:45	Measuring the two-photon Gouy phase (Markus Hiekkamäki & Rafael Barros)
10:45-11:15	Coffee Break
11:15-12:00	Machine Learning Applications to Ultrafast Photonics (Goery Genty)
12:00-13:30	Lunch Break
13:30-14:15	Discussion on Research and Educational Collaborations
14:15-15:00	
15:00-15:30	Coffee Break
15:30-16:15	
16:15-17:00	Final Discussion and Closing Remarks
17:00-17:45	

Budget

Available funds:

- 6000 €
jointly from Institut Français in Helsinki, the French Ministry of Higher Education, Research and Innovation, the Finnish Academy of Sciences and Letters and the Finnish Society of Sciences and Letters
- 6000 €
Tampere University and PREIN photonics flagship of the Academy of Finland
- 1000 €
Ecole Centrale de Marseille

Supported activities:

- 3050 €
accommodation for students and postdocs
- 2050 €
lunch and coffee catering
- 2100 €
workshop dinner
- 600 €
lecture hall rent
- 5200 €
travel support for students and postdocs