POST-DIGITAL - European Training Network on Post-Digital Computing [GA860360]

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EXECUTIVE SUMMARY

The **Open-To-All Workshop OTAW II** was organised by the University of Trento, the Nanoscience laboratory, and the POST-DIGITAL beneficiary Institute for Cross-Disciplinary Physics and Complex Systems (**IFISC**) of the University of the Balearic Islands. **The 11 Optoelectronics and Photonics NMP2021** was organised in a collaboration with other 4 projects: ERC-AdG project BACKUP and the PRIN 2017 project PELM, EID FONTE and EID REAL-NET. The OTAW2 was held on **20 to 26 June 2021 as a hybrid event**.

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LIST OF ACRONYMS

AiPT	Aston Institute of Photonic Technologies
EC	European Commission
ESR	Early Stage Researcher
ETN	European Training Network
POST-DIGITAL	Project 'POST-DIGITAL - European Training Network on Post-Digital Computing' EC GA 860360
OTAW	Open-To-All Workshop
ULB	Université libre de Bruxelles
IFISC	Institute for Cross-Disciplinary Physics and Complex Systems
CSIC	Spanish National Research Council
UIB	Universitat de les Illes Balears

1 11TH OPTOELECTRONICS AND PHOTONICS SUMMER SCHOOL

The 11th edition of the classical Optoelectronics and Photonics School was originally planned as a Winter School on 17-23 January 2021. The event was postponed due to the COVID-19 pandemic and was held as hybrid Summer School on 20-26 June 2021. Interested parties were able to take part online whereas there was also an extended programme for participants on-site. The event offered the first opportunity for POST-DIGITAL ESRs to meet in person and was a very positive experience for them. Organizers of the event were University of Trento, the Nanoscience laboratory, and the Institute for Cross-Disciplinary Physics and Complex Systems (IFISC) of the University of the Balearic Islands.

The Open-to-all workshop II focussed on Neuromorphic Photonics and addressed PhD students and young researchers with an optics background. It introduced them to the concepts of neuromorphic photonics, focusing on the hot topics that are driving the technological and scientific research in this field.

The programme of the Summer School involved introduction of the general concepts about the biological brain behaviours and neuroscience, with particular attention to their implementation in machine learning and complex networks. Further lectures focused on different kind of neuromorphic photonic platforms (from lasers and diffraction systems, down to integrated photonics chips) and on applications like photonic accelerators, optical device optimization and telecommunications.

In addition to standard classes, rump evening sessions on hot topics in the field were organized to facilitate discussions among students and lecturers.

1.1 TOPICS ON THE 11TH OPTOELECTRONICS AND PHOTONICS SUMMER SCHOOL

The Summer School in Trento was organized in three main areas, each of which is divided in subareas.

1. **Introduction**
    1. Brain physiology
    2. Neuroscience
    3. Reservoir computing
    4. Machine Learning/ Deep learning
    5. Complex Networks
    6. Quantum Machine Learning
    7. Neuromorphic Computing
2. **Photonic platforms**
    1. Delay Systems
    2. Diffraction Systems
    3. Spiking Networks
    4. Swirl
    5. Scissors
    6. VCSELs
    7. Phase Change System
    8. Ising Machines
3. **Applications**
    1. Photonics accelerator
    2. Optical device Optimization
    3. Telecommunications

1.2 SPEAKERS AND TOPICS

- **Brain**, Beatrice Vignoli, University of Trento
- **Neuromorphic Computing (HW)**, Claudio Gallicchio, University of Pisa
- **Machine Learning/Deep Learning**, Elisa Ricci, University of Trento
- **Complex Networks**, Inmaculada Leyva, Rey Juan Carlos University
- **Photonics Reservoir Computing**, Serge Massar, Free University of Brussels
- **Delay systems**, Miguel Cornelles Soriano, IFISC
- **Diffraction systems (Pelm)**, Claudio Conti, Sapienza University
- **Neuromorphic silicon photonics**, Paul Prucnal and Bhavin Shastri, Princeton University
- **Scissor**, Mattia Mancinelli, University of Trento
- **VCSEL**, Antonio Hurtado, University of Strathclyde
- **Phase change system**, Wolfram Pernice, University of Münster
- **Ising Machine**, Hiroki Takesue, NTT Data
- **Photonics accelerator**, Laurent Daudet, LightOn
- **Other Applications**, Apostolos Argyris, IFISC
- **Nonlinear phenomena in telecommunication**, Sergei Turitsyn, Aston University

1.3 POST-DIGITAL PARTICIPANTS

Several prominent members of the POST-DIGITAL consortium contributed to the event as speakers: **Apostolos Argyris,** IFISC (CSIC-UIB), Spain, **Miguel C. Soriano,** IFISC (CSIC-UIB), Spain, **Sergei Turitsyn,** Aston University, UK, **Serge Massar,** ULB, Belgium and **Laurent Daudet,** LightOn, France. **Claudio Mirasso,** IFISC (CSIC-UIB), Spain was key organiser of the event.

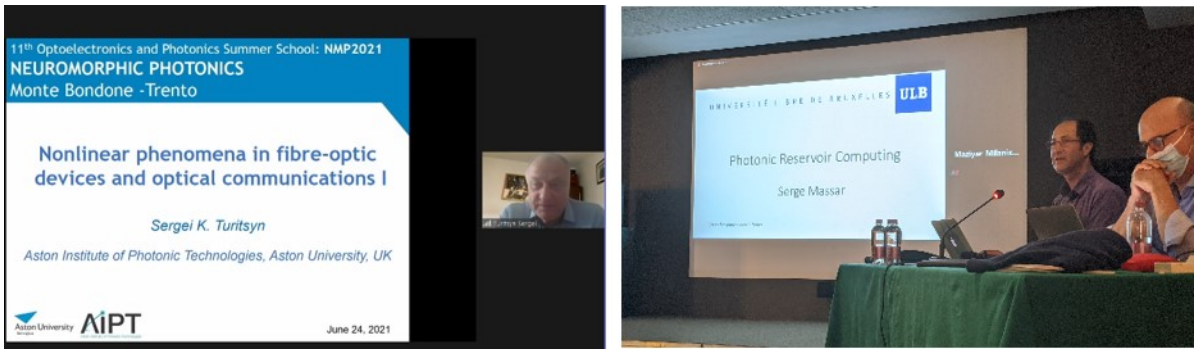


Figure 1. Prof S. Turitsyn (AiPT) and Prof S. Massar (ULB) giving presentations on the 11th Optoelectronics and Photonics Summer School

The event addressed researchers from several countries like Italy, France, Spain, India, Germany, Netherland, United Kingdom, USA, Belgium, Denmark, Serbia and Switzerland. Among the 60 participants of the workshop (around 20 people onsite and 40 people online) were 9 POST-DIGITAL ESRs:

Diego Arguello Ron (Aston)
Mirko Goldmann (IFISC)
Tigers Jonuzi (VLC Photonics)- in person
Guillaume Pourcel (Groningen)
Lucas Talandier (IFISC)- in person
Ivan Boikov (Thales)- in person
Long Hoang Nguyen (Aston)
Steven Abreu (Groningen)
Alessandro Lupo (ULB)- in person

Figure 2. The Open-to-all Workshop II in Trento, Italy as a hybrid event

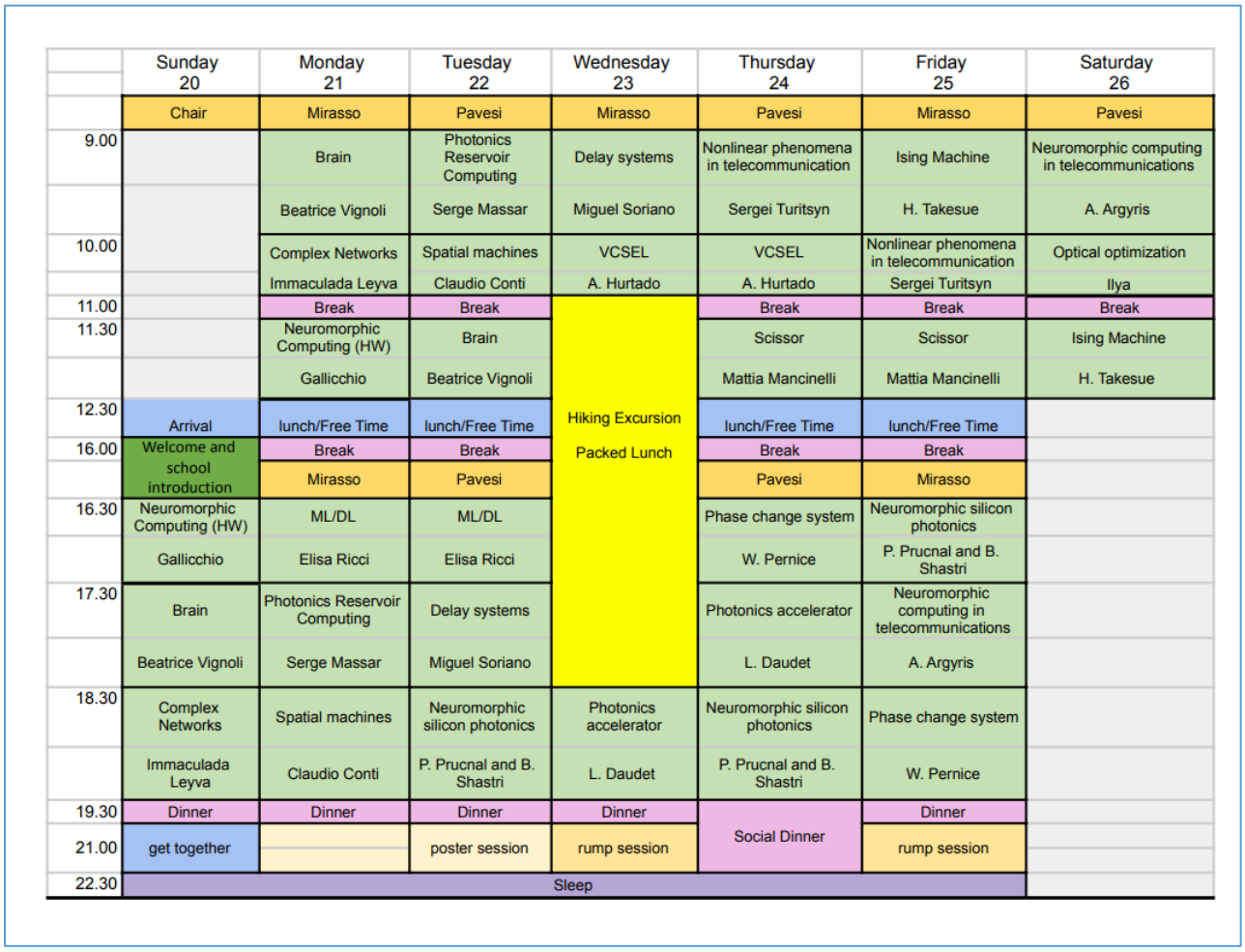
1.4 PROGRAM OF THE SECOND OPEN-TO-ALL WORKSHOP (OTAW II)

The Summer School began on Sunday 20th June 2021 in the afternoon. After welcoming remarks, the first introductory lectures started. In the evening, an ice-breaking event was organized by the SPIE Student Chapter of the University of Trento.

From Monday to Friday the agenda was as following:

- Morning session (9.00-12.30). Three lectures with one coffee break
- Lunch and long break to mountain sport and discussion
- Afternoon session (16.30-19.30). Three lectures
- Dinner
- Evening session (after 21.00). Different events for each day, including rump sessions, social dinner and poster sessions

On Saturday 26 June 2021, the Summer School was closed with a special ceremony.



	Sunday 20	Monday 21	Tuesday 22	Wednesday 23	Thursday 24	Friday 25	Saturday 26
	Chair	Mirasso	Pavesi	Mirasso	Pavesi	Mirasso	Pavesi
9.00		Brain	Photonics Reservoir Computing	Delay systems	Nonlinear phenomena in telecommunication	Ising Machine	Neuromorphic computing in telecommunications
		Beatrice Vignoli	Serge Massar	Miguel Soriano	Sergei Turitsyn	H. Takesue	A. Argyris
10.00		Complex Networks	Spatial machines	VCSEL	VCSEL	Nonlinear phenomena in telecommunication	Optical optimization
		Immaculada Leyva	Claudio Conti	A. Hurtado	A. Hurtado	Sergei Turitsyn	Ilya
11.00		Break	Break	Hiking Excursion Packed Lunch	Break	Break	Break
11.30		Neuromorphic Computing (HW)	Brain		Scissor	Scissor	Ising Machine
		Gallicchio	Beatrice Vignoli		Mattia Mancinelli	Mattia Mancinelli	H. Takesue
12.30	Arrival	lunch/Free Time	lunch/Free Time		lunch/Free Time	lunch/Free Time	
16.00	Welcome and school introduction	Break	Break		Break	Break	
		Mirasso	Pavesi		Pavesi	Mirasso	
16.30	Neuromorphic Computing (HW)	ML/DL	ML/DL		Phase change system	Neuromorphic silicon photonics	
	Gallicchio	Elisa Ricci	Elisa Ricci		W. Pernice	P. Prucnal and B. Shastri	
17.30	Brain	Photonics Reservoir Computing	Delay systems		Photonics accelerator	Neuromorphic computing in telecommunications	
	Beatrice Vignoli	Serge Massar	Miguel Soriano		L. Daudet	A. Argyris	
18.30	Complex Networks	Spatial machines	Neuromorphic silicon photonics	Photonics accelerator	Neuromorphic silicon photonics	Phase change system	
	Immaculada Leyva	Claudio Conti	P. Prucnal and B. Shastri	L. Daudet	P. Prucnal and B. Shastri	W. Pernice	
19.30	Dinner	Dinner	Dinner	Dinner	Social Dinner	Dinner	
21.00	get together		poster session	rump session		rump session	
22.30	Sleep						

Figure 3. Programme of the 11th Optoelectronics and Photonics Workshop in Trento, Italy

The Open-To-All Workshop II was the **first opportunity** for POST-DIGITAL Early Stage Researchers to meet in person. During the evening sessions and the hiking trip they had the opportunity for discussions and socializing with other MSCA fellows and established researchers from different organisations. After one year of online contacts and virtual events the second Open-to-all workshop was a very positive experience for our ESRs and was a huge step in consolidating the student cohort and facilitating networking among the consortium.

Figure 4. The participants of the Open-to-all workshop II on a hiking trip in the Italian Alps

Figure 5. POST-DIGITAL ESRs by gathering together with colleagues from other projects

1.5 WEBSITES AND SOCIAL MEDIA

The 11th Optoelectronics and Photonics Summer School in Trento was announced on the websites of POST-DIGITAL and on twitter, it was also discussed on 2 supervisory board meetings and several invitations have been sent to the project network.

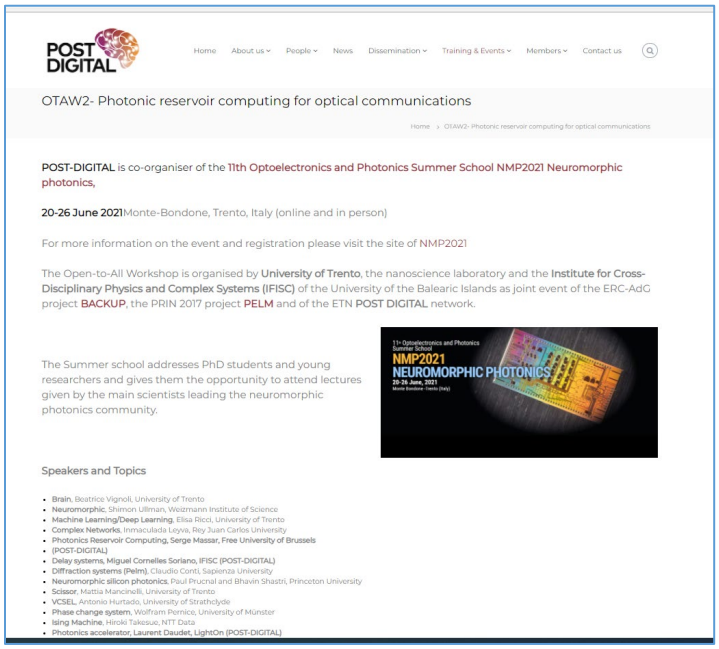


Figure 6. The 11th Optoelectronics and Photonics Summer School 2021 on the POST-DIGITAL website

Figure 7. The 11th Optoelectronics and Photonics Summer School 2021 on twitter