UNIVERSITY OF PORTO SPIE STUDENT CHAPTER

ANNUAL ACTIVITY REPORT 2017

President: Nuno Silva
Vice-President: André Gomes
Treasurer: Catarina Monteiro
Secretary: Ruben Alves

Advisor: José Luís Santos, Full Professor at Faculty of Sciences of University of Porto
ABOUT US

The University of Porto SPIE Student Chapter was officially formed on August 17th 2012 and it is proudly the first SPIE Student Chapter ever formed in Portugal.

Currently, our chapter is made up of fourteen student members and one alumni. Our members are graduate and undergraduate students with a wide range of interest in optics and photonics and most of us, students at the Physics and Astronomy Department of the Sciences Faculty of University of Porto (FCUP)

The University of Porto SPIE Student Chapter also has full support of the Department of Physics and Astronomy of FCUP, SPOF and INESC TEC.

OUR MISSION

The Chapter is engaged in promoting optics and photonics in Science and Engineering through various activities taking place throughout the school year at the University of Porto / INESC TEC, targeting younger (high school) and also undergraduate and graduate students.
CHAPTER OFFICERS FOR THE YEAR 2018

The new officers were elected on November 29th, 2017.

President

André Gomes  
ardcgomes@gmail.com
SPIE number: 3692390

Vice-President

Catarina Monteiro  
catarina.smonteiro@hotmail.com
SPIE number: 3716263

Secretary

Miguel Ferreira  
miguel.fs.ferreira93@gmail.com
SPIE Number:

Treasurer

Vítor Amorim  
vitor.a.o.a@hotmail.com
SPIE number:

LIST OF CURRENT STUDENT CHAPTER MEMBERS

14 regular student members at the date of writing

Cesar Ivan Alvarez  
Vítor Amorim  
Nuno Azevedo Silva  
João Costa  
Behdad Dasht Bozorg  
Miguel F. Ferreira  
Rita Lima  
João Maia  
Tiago J. Martins  
Catarina Monteiro  
Ana Rita Rodrigues Ribeiro  
António Vaz Rodrigues  
Carlos Duarte Viveiros  
Bachar Wehbe

plus 1 alumni member

Manuel Jorge Marques
DETAILS OF CHAPTER ACTIVITIES IN THE YEAR 2017

Regular meetings during school year

Aiming at the interaction and the discussion of the activities to be organized, the chapter held regular meetings between our student chapter members. These meetings were organized along the year, more or less once per month. The average of student members present in the meetings was around 70%.

Regular Scientific meetings

As usual, the chapter was actively involved during 2017 in the organization of scientific meetings, where an experienced researcher talks about a specific aspect of research. These meetings were held at FCUP and aimed towards a share of knowledge between the more experienced researchers of our community and the students, particularly the undergraduate ones.

1. 9th February 2017

Development and application of phenol based indicators for optical sensors

Professor Barna Kovacs

Abstract: Some years ago, a brainstorming with INESC Porto researchers led to the introduction of p-nitrophenol as promising indicator for optical CO2 detection. Later on novel dimeric and polymeric indicators by using p-nitrophenol monomers have been prepared. By incorporating the novel indicators into various matrices CO2 sensors (for dissolved and gas phase measurement) as well as pH sensors have been developed using interferometric (LPG) and absorption/reflection based sensing arrangements.

In this talk the preparation of the novel indicators, their immobilization onto different substrates (such as glass, polymer or nanobead) will be shown. Also existing and possible sensor’s designs with and without internal referencing, and their current applications and known limitations will be discussed.
2. 2\textsuperscript{nd} March 2017

\textit{In Vivo Optical Single Unit Recording of Neural Activity using Focused Ion Beam Milled Fabry-Perot Cavities in Optical Fiber Micro-tips}

Professor Mohammad Ismail Zibaii

Laser and Plasma Research Institute, Shahid Beheshti University, Iran

Abstract: We propose an optical method for in vivo neural recording using a Fabry-Perot cavity milled with focused ion beam on a tapered fiber tip. Optical fiber micro-tips are promising devices for sensing applications in small volume and difficult to access locations, such as neuroscience research. The fiber-based probe is electrical artifact free, labeling free, and feasible for a portable system compared with conventional in vivo neural recording systems. In this experiment simultaneously detected optical signals and electrical neural activity from the rat somatosensory cortex. This fiber-based probe promises the enhanced ability to record in vivo neural activity for the investigation of neurons and can be integrated with optrodes in optogenetics techniques for simultaneous optical stimulation and optical recording.

3. 16\textsuperscript{th} March 2017

\textit{Apresentação do Laboratório de Alta Tensão/UFCG e Prospecção de Pesquisas}

Professor George R. S. Lira

Laboratório de Alta Tensão, Departamento de Engenharia Elétrica, Universidade Federal de Campina Grande, Campina Grande, Brazil

Abstract: General vision of the activities, research areas and R&D projects of Universidade Federal de Campina Grande and of the Laboratório de Alta Tensão.
4. 20th April 2017

An overview of the Optical Turbulence Effects

Dr. Hodjat Mariji

Postdoctoral Researcher at Institute of Telecommunications, University of Coimbra

Abstract: The amplitude and the phase of propagating electromagnetic waves are disturbed with respect to the fluctuations of the refractive index of the atmosphere (optical turbulence). In this talk, after a brief introducing of my research background, I will explain about the effects of optical turbulence and present some numeric results.

CAP talks series

For the year of 2017, the chapter co-organized a new series of scientific meetings: the CAP talks series. These were the result of a collaboration between the chapter and the INESC TEC Centre for Applied Photonics and were especially thought for our community and towards the presentation and scientific divulgation of the research and projects held by the young and more experienced researchers currently developing some work at the Centre for Applied Photonics.

1. 23rd February 2017

Spectroscopy for Complex Biological Systems: From Hardware and Firmware to Self-Learning Artificial Intelligence

Dr. Rui Martins

PostDoc Researcher, Centre for Applied Photonics/ INESC TEC, Porto

Abstract: Spectroscopy is a powerful analytical technology for gathering high-throughput information of complex biological systems. Extracting, interpreting and quantifying physical and chemical information present in the spectra, is the key of the success of this non-invasive, non-destructive, 'in-vivo' and real-time technology. In the last 12 years, I have been developing hardware, firmware, signal processing and artificial intelligence systems for quantifying the metabolism of plants, animals and humans. This presentation shows the evolution of engineering scientific research
and developments necessary to achieve the state-of-the-art of MedPAT, VetPAT and VinePAT technologies. Key aspects of spectroscopy in terms of hardware, firmware, signal processing and artificial intelligence will be discussed, and how spectroscopy has today the capacity of, for example, performing high-throughput medical and veterinary clinical analysis with less than a drop of blood, or performing non-invasive measurements with analytical precision. The same technology is being applied in agriculture to perform hyper-spectral and metabolic imaging systems for managing crops and high-quality Port wine production. Future trends of spectroscopy challenges will be introduced and why this technology is the future of non-invasive diagnosis in many fields of application, from agriculture, mining, environment, industrial processes, healthcare and well-being.

2. 9th March 2017

Fabrication of integrated optical devices in fused silica by femtosecond laser direct writing

Vitor Amorim
PhD Student, Centre for Applied Photonics/ INESC TEC, Porto

Abstract: Historically, important integrated optical devices have been developed using lithographic techniques. However, recent advances in the femtosecond laser direct writing technique have also enabled the fabrication of such devices, due to the inherent high resolution of the process, while providing 3D capabilities. In this presentation basic devices fabricated by this technique will be discussed, and its implementation in more complex devices such as add-drop multiplexers will be demonstrated.

3. 30th March 2017

When Physics meets Public Health: X-ray Fluorescence and other spectroscopy techniques

Dr. Diana Guimarães
PostDoc Researcher at INESC TEC / CSIG - Centro de Sistemas de Informação e de Computação Gráfica

Abstract: Understanding how trace elements affect public health is important. From evaluating the nutritional role of essential
elements, such as Ca, Cu and Zn, to assessing exposure to toxic elements such as Pb, Cd, Hg and As, the use of state-of-the-art analytical techniques based on atomic spectrometry is crucial. In this talk multiple projects concerning biomonitoring and environmental analysis of trace elements will be shown. This includes the analysis of a wide range of samples, from food, cosmetics, medicines to consumer products and biological samples. The emphasis will be given to the use of X-ray fluorescence (XRF) spectrometry, a non-destructive technique, that allows simultaneous multi-elemental analysis with a wide dynamic concentration range from percent down to $\mu g/g$ levels.

4. 4th May 2017

*Optical sensors: from physical parameters to radiation monitoring*

**Catarina Monteiro**

Researcher at Center for Applied Photonics / INESC TEC, Porto, Portugal

Abstract: Fiber optics has found many applications as sensors for physical and chemical parameters. The low cost, immunity to electromagnetic interference and low propagation loss made fiber optics a suitable alternative for traditional mechanisms. In this presentation, some examples of optical fiber sensors for curvature, strain and pressure will be demonstrated and the development of a new optical sensor for radiation monitoring in water will be discussed.

5. 1st June 2017

*Optical sensors: Polymer optical fibers and LiBS*

**Miguel Ferreira**

Researcher at Center for Applied Photonics / INESC TEC, Porto, Portugal

Abstract: The use of polymer optical fibers for sensing purposes has been increasing in the last years. The inscription of fiber Bragg gratings and long period gratings in polymer fibers leads to the
fabrication of sensing devices. Microstructured polymer optical fiber have also been developed and benefit of being endlessly single-mode. Laser induced breakdown spectroscopy is a technique that allows the detection of elements through the deexcitation of electrons in a laser induced plasma. Each element has its own energy levels that leads to the emission of photons with specific wavelengths. In this presentation, several sensing devices will be presented, plus a connection between an MPOF and tapered silica fiber and the current progress with LIBS will be shown.

6. 13th June 2017

Optical sensors based on lossy mode resonances

Joaquin Ascorbe Muruzabal

Researcher at Public University of Navarra, Navarra, Spain / Center for Applied Photonics - INESC TEC, Porto, Portugal

Abstract: The main topic of the talk will be optical fiber sensors based on Lossy Mode Resonances (LMR), although some other structures will be presented. The structure of a LMR-based device consists of a waveguide, which allows for accessing the evanescent field, coated with a thin film of the appropriate material. Despite similarities between LMRs and Surface Plasmon Resonances (SPR), important differences can be distinguished between both phenomena. What makes them similar is that both are electromagnetic resonances that generate an attenuation band on the transmitted spectrum. One of the main differences is the possibility of being observed on the transverse magnetic (TM) and transverse electric (TE) modes. However, one of the most relevant factors that make LMRs a good choice for optical fiber sensors development is their ability to generate an optical phenomenon that can be detected by the wavelength detection method with the same material that acts as the sensitive layer to the parameter to be measured. Sensors for several purposes, such as chemical or biological detection, humidity sensing and pH measurements, among others, can be developed using this optical phenomenon.
STUDENT OFFICER TRAVEL GRANT

Nuno Azevedo Silva participated in Optics and Photonics 2017. He attended the leadership workshop, representing the UP SPIE Student Chapter.

ORGANIZATION OF ACTIVITIES FOR UNDERGRADUATE AND GRADUATE STUDENTS

Participation in “Open Days 2017” to schools

Annually, the Faculty of Science of University of Porto (FCUP) hosts the “Open Days” to schools. This initiative is aimed at secondary school students, especially those who are in the process of vocational guidance. These students had the opportunity to take a close look at a group of activities divided into FCUP's several knowledge areas, participating in guided tours to the facilities of the different departments and research centers. The goal is to provide students with a direct contact with the FCUP training opportunities and information on the professional outputs given by graduations and master degrees. The "Open Days" are performed during two days, where tours to the various laboratories of the Faculty are organized.

The visits are organized by area and require prior registration in each area who are interested in visiting [Biology, Physics and Astronomy, Geosciences, Environment and Spatial Planning (Geology, Environment, Geographic Engineering, Food Engineering, Agricultural Engineering, Landscape Architecture); Computing, Mathematics, Chemistry and Biochemistry]. All students and teachers have informational materials about the courses available at FCUP. This activity aims to set up an informal table in the department stand with SPIE promotional materials, handouts, and membership applications during the event.

The FCUP Open Days took place in February 18th and 19th. The UP SPIE Student Chapter was represented by its members through a series of outreach activities closely related to the research areas of INESC Porto.

Place of event: Department of Physics and Astronomy, Faculty of Sciences of University of Porto.

Date: March 3rd and 4th, 2017.
OTHER EVENTS

JEFFA 2017 – Jornadas de Engenharia Física e Física Experimental

The 2nd Workshop on Engineering Physics and Experimental Physics was held in the department of Physics and Astronomy, Faculty of Sciences of the University of Porto. This workshop is the result of a collaboration between all member groups of the department of Physics and Astronomy and it aims at the divulgence of the current challenges and outlook in the diverse areas focused by each group. With testimonies from the Directors of the Integrated Research Institutes, scientific talks from Ph.D. students and flash presentations from Master students from those centers, this event constitutes a great opportunity for all our scientific community.

During the coffee break, a poster session engaging postgraduate students occurred, which constituted an excellent moment for socialization between all members of the DFA-FCUP.

AOP 2017

Established as one of the most important international conferences in optics organized in Portugal, the biannual AOP 2017 was held in Faro from 8th to 12th of May 2017. The chapter was involved as an active sponsor, with a desk of SPIE promotional material. Also, many of our student members participated actively in the conference with oral and poster presentations about their work.

The chapter had the opportunity to meet the SPIE Immediate Past President, Robert Lieberman. A fruitful discuss with him about future challenges and the role of SPIE on helping students to give the next step towards early career researchers took place during lunch time.

2nd Doctoral Congress in Engineering – Symposium on Engineering Physics

The 2nd Portuguese Doctoral Symposium on Engineering Physics took place on the 8th and 9th of June 2017, at Faculty of Engineering of the University of Porto (FEUP). The Symposium was integrated in the Doctoral Congress in Engineering. Several communications (oral and poster) by Master and PhD students on different topics of Physics Engineering/Applied and Technical Physics were presented. The Symposium on Engineering Physics was supported by our SPIE Student Chapter. Some of our student chapter members presented their work at the symposium.
DETAILS OF PLANNED ACTIVITIES FOR THE FUTURE

Activities proposed by the University of Porto SPIE Student Chapter for the year 2018:

**Organization of the Fourth Edition of ‘Let’s talk about science’**
With this initiative the Chapter aims to promote a special scientific meeting with the SPIE invited speaker and other lecturers invited by the Chapter.
Venue: Faculty of Sciences, University of Porto
Date: To be announced

**Organization of regular meetings during the school year**
The objective of these meetings is the interaction and experience sharing between the chapter members, as well as to plan and organize the proposed activities along the year.
Venue: Faculty of Sciences, University of Porto
Date: Bimonthly

**Scientific Meetings**
Scientific meetings are held to promote discussion and knowledge sharing between students (from undergraduate to graduate students) and researchers, from industry or academia. They are also a great opportunity to establish new collaborations and networks.
Venue: Faculty of Sciences, University of Porto
Date: During the year 2018 (whenever possible)

**Scientific Workshops**
Organize workshops on practical topics of interest for our student members and the scientific community. These workshops involve topics such as paper writing, presentation and poster preparation, how to review a paper for a journal, among others.
Venue: Faculty of Sciences, University of Porto
Date: During the year 2018 (Whenever possible)

**CAP Talks Series**
Co-organize the series of scientific meetings called the CAP talks series that started in 2017 with a collaboration between the chapter and the Centre for Applied Photonics of INESC TEC. The aim is to disseminate and discuss the research and projects held by the young and more experienced researchers currently developing some work at the Centre for Applied Photonics.
(5th) Participation in “Open Days” to schools

The Faculty of Science of University of Porto (FCUP) hosts the “Open Days” for schools. This initiative aims to target secondary school students, especially those who are in the process of vocational guidance. The goal is to provide students with a direct contact with the FCUP training opportunities and information on the professional outputs given by graduating students and master degree students. The “Open Days” last for two days, where several tours to the several labs of the faculty are organized. The visits are organized by area and require prior registration in each area by those interested [from biology to even food engineering]. All students and teachers have informational materials about the courses available at FCUP. This activity aims to set up an informal table in the department stand with SPIE promotional materials, handouts, and membership applications during the event. The SPIE outreach kit is used to promote the contact between students and optics.
Venue: Faculty of Sciences, University of Porto
Date: February, 2018

(4th) Participation in “Mostra da Ciência da U.Porto”

The Science, Teaching and Innovation Display at the UP is the ideal space to realize the diversity of degrees of University of Porto, but also to explore several aspects of the scientific knowledge. It is thought as a space for informal exchange of views, where it is possible to question, experiment, and participate. The Science, Teaching, and Innovation Display at the U. Porto are directed to high school students that are in a phase of making choices for their future, but also for all those interested in knowledge (scientific, technological, humanistic, and artistic). This fair is also an ideal opportunity to understand the impact that the University of Porto has in our society and in the countries development. This activity aims to set up an informal table in the department stand of “Mostra de Ciência” with SPIE promotional materials, handouts, and membership applications during the event.
Venue: Pavilhão Rosa Mota – Porto
Date: March, 2018

Support the 3rd Symposium on Engineering Physics and other Topical Meetings

The symposium on engineering physics, and as well other topical meetings and conferences, are great opportunities to promote the Chapter and SPIE to new students and researchers, with the help of the SPIE promotional material and handouts.

Web page and Facebook management

As in the previous year, the website/Facebook will be used to inform the students of the activities developed by the University of Porto SPIE Student Chapter.
FINANCIAL INFORMATION

**Annual budget**

All figures are presented in Euros, at the conversion rate considered at the time of the transaction.

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<th>Date</th>
<th>Description</th>
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