NEWSLETTER

COMMISSION INTERNATIONALE D'OPTIQUE · INTERNATIONAL COMMISSION FOR OPTICS

Optics Outreach Blooms Again in Pakistan

Our future is bright if we let these girls to SHINE...

For the Active Learning in Optics (ALO) group, the start of 2022 brings many positive hopes of doing outreach activities uninterrupted.

The COVID-19 pandemic has added a new variable of uncertainty in our respective lives. It has caused dramatic loss of human life across the globe and has led to devastating social and economic disruption. Closure of educational institutes impacted student learning and it is yet to be ascertained as to how the rapid conversion to online instruction affected student achievement. These unprecedented circumstances bring a new set of challenges for the already struggling academic communities. The impact is more severe for developping and economically disadvantaged countries and has led to interrupted learning, compromised healthcare, nutrition and worsening economic conditions. The year of 2022 comes with a different set of challenges for struggling economies of countries like Pakistan. We visited various public sector universities, colleges and schools for outreach Optics activities. Now as this year is ending we can say it was productive year for us and for students we catered. In first half of this year, our first visit was to a newly established university called University of WAH, Department of Physics (2nd April2022) It has a total strength of 350 students. The program started with the lecture of light and light-based technologies. Later, using optics kits, we performed different experiments including diffraction, scattering, geometrical laws of optics, total internal reflection and fiber optics etc. It was a very satisfying experience for us.

Explore Optics Kits by SPIE were used for hands-on Optics activities with 73 girls students from grade 4/5.

Thorlabs' kits will help undergraduate and even graduate students to see and understand physical effects of experiments.

The second activity was in a private school named, "Head-Start". Most schools opt for Alternate to Practical (ATP), a theoretical instead of a laboratory course. We wanted to help the students have a hands-on experience with optics. While limited to one day, we hope the students gained valuable experience and understanding as they interacted with some optical elements and observed optical phenomena for the first time in their course of studies. The third activity is close to my heart. The school we visited is located in a sector that belongs to middle salaried class. As a note in Asian culture, middle class families often have many children. It is typical to fight for almost everything with one's siblings, sometimes even for love. One of the activities is to draw reflection of an image using reflect view to understand virtual image from a flat mirror. Their effort to hold one of reflects view and do not let it go until virtual image of clown is done neatly. They were happy after the activity and what a rewarding day we had. I would like to add one photo that is the reflection of their determination and strong will to learn.

In November we did a week-long activities at The black Hole for Grade 7 to Grade 11 students from another Private school named Khaldunia.

Transition from Toys to …Thorlabs !

In Feb. 2020 Winter College on Optics was the last in-person activity that took place at ICTP before COVID lockdown. Then ICTP went into silent mode for a long period. Slowly online activities started and first virtual ICTP College on Optics took place from 16th - 20th May 2022, in connection with international Day of Light. The topic was Theory and Applications of LIDAR. The hands-on sessions are always very important part of Preparatory School to Winter College on Optics, but for online activity it was not possible. For ALO hands-on activities, we planned to make models to describe working principle of LIDAR. We made models of Michelson, Mach-Zehnder and Sagnac Interferometer and two models of Ring-laser and Fiber-Optics Gyros. Our students got an idea how they work but were not able to use these models made of toys. Wanting to help give the students a richer experience, ICO president John Howell, offered equipment to make interferometers, LIDAR. Owing to regulations, he was not able to send equipment from Israel to Pakistan. He came up with many ideas to get support for my students and me. Finally, we managed to have meeting with Thorlabs representative, Jamie LaCouture. She very kindly agreed to send two educational kits from their office in Germany and connect me with Francesco Zingariello, the Sales Team leader. He was a very kind and positive person. He supported me all the way from Germany Sales office to Quaid-i-Azam University. Now I am proud to have two educational kits for my students and a very good friend Francesco. These two kits are the most advanced equipment for our outreach activities. They will help our under-graduate and even graduate students to see and understand physical effects of experiments. With addition of these kits, we can now organize some advanced workshops on Optics. As these kits easily fit in a car trunk we are planning to take them to newly established women's universities in remote areas of Pakistan, where they only read theory and do not have lab facilities.

Dr. Imrana Ashraf

Quaid-i-Azam University, Pakistan

ICO Prize to Nanoscale Light-Matter Interactions

The 2022 ICO Prize was awarded for "seminal contributions to the spin-orbit interaction optics that largely expand our capacities to manipulate light-matter interaction at the nanoscale".

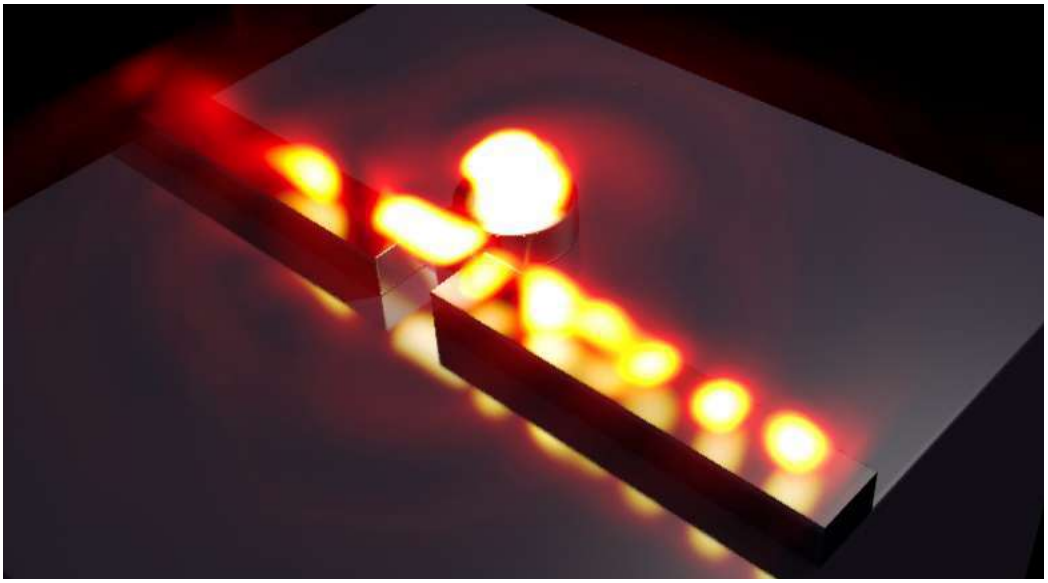
Francisco J. Rodríguez-Fortuño is working at the Department of Physics at King's College London (UK).

Dr. Rodríguez-Fortuño earned his Telecommunications Engineering BSc, MSc and PhD at Universitat Politècnica de València, Spain, with long research stays at University of Pennsylvania (USA) and King's College London (UK), where he became a postdoc and later obtained a permanent academic position in 2015, starting his own research team. The prize was awarded for Francisco's contributions on spin-momentum locking in near fields and related spin-orbit interactions of light. With the seminal discovery of the universal near-field directionality of circularly polarized dipoles [1], later linked to spin-momentum locking, Francisco and his team extended the phenomenon beyond spin [2], proposing alternatives such as the Janus dipole [3], [4], as well as investigating the novel applications that the phenomena enabled in optical nano-routing [5], [6], optical and Casimir forces [7], [8], and in integrated polarimetry [9], [10] among others. Inspired by these results, Francisco's current research focuses on novel electromagnetic phenomena in the near-field. This regime occurs at sub-wavelength distances from sources, scatterers, or waveguides, and results in electromagnetic field behavior that is very different to the far-field. Many assumptions, such as electric and magnetic polarization being transverse to the wave-vector, or the diffraction limit of light, break down, leading to exciting new possibilities: three-dimensional polarizations, high intensity hotspots, high density of states, strong field gradients, unintuitive Casimir and fluctuation-induced forces, etc. These give rise to a plethora of near-field applications for the control of light-matter interactions, optical nano-routing, sensing, polarimetry, optical forces, interaction with chiral matter, and many others which Dr. Rodríguez-Fortuño's team aims to explore.

REFERENCES:

[1] Science, 340, 6130, 328–330, 2013.
[2] Opt. Photonics, 30, 2019.
[3] Europhys. News, 49, 4, 14–18, 2018.
[4] Phys. Rev. Lett., 120, 11, 117402, 2018.
[5] Nat. Commun., 5, p. 5327, 2014.
[6] Nat. Commun., 5, p. 3226, 2014.
[7] Nat. Commun., 6, 1, 8799, 2015.
[8] Phys. Rev. Lett.,118, 133605, 2017.
[9] ACS Photonics, 1, 9, 762–767, 2014.
[10] Nano Lett., 17, 5, 3139–3144, 2017.

ICO VP Prof. Leszek Sirko chairs the ICO Award Committee



Render of scattered magnetic field when a silicon nano-disk next to a nanophotonic waveguide is illuminated by circularly polarized light, showing near field directionality, forming the basis of an integrated polarimeter.

ICO/IUPAP Young Scientist Prize in Optics 2022

"For seminal contributions to computational phase imaging and metrology, particularly non-interferometic quantitative phase imaging and high-speed phase measuring profilometry"

Prof. Chao Zuo is a Full Professor at the Department of Optical Engineering, Nanjing University of Science and Technology (NJUST), China.

Prof. Chao Zuo received his B.Eng. degree from Zijin College, Nanjing University of Science and Technology (NJUST) in 2009. After receiving his Ph.D. from NJUST in 2014, Chao Zuo was exceptionally promoted to Associate Professor (2014) and Full Professor (2016) in the Department of Optical Engineering of NJUST. He now leads the Smart Computational Imaging Laboratory of NJUST, and he is also the founder and director of the Smart Computational Imaging Research Institute of NJUST.

His research is focused on Phase Measuring Imaging Metrology techniques such as digital holographic microscopy, quantitative phase imaging, and fringe projection profilometry (FPP).

Prof. Zuo and his group have developed systematic theories and methods for non-interferometric quantitative phase imaging and diffraction tomography based on intensity-only measurements. They established the generalized transport of intensity equation for partially coherent fields [1], and formulated the theory of phase optical transfer function for partially coherent illuminations [2] as well as seminal approaches for non-interferometric phase imaging and diffraction tomography [3-4]. Their pioneering work has opened a new era, paving the way toward a new generation of label-free 3D microscopy, developing several "Smart Computational Light Microscopes" to tackle many challenging problems in biology, medicine, and metrology [5].

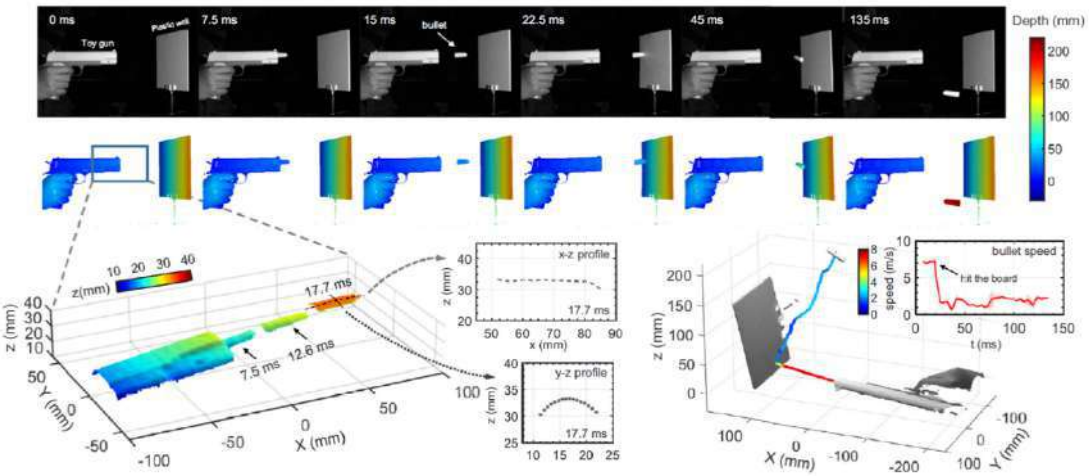
Due to his contributions to computational phase microscopy, Prof. Zuo was awarded the AMA Innovation Award (2016), JPhys Photonics Emerging Leaders (2020), and "Gold Medal with Congratulations of the Jury" at Geneva's International Exhibition of Inventions (2022). Prof. Zuo and his team have also established systematic theoretical frameworks for phase measuring profilometry, [6-7], developing a series of composite phase-shifting algorithms for high-speed 3D sensing [8]. Prof. Zuo's group is also a pioneer in applying deep learning to optical metrology, with a focus on fringe pattern analysis and FPP [9-12].

REFERENCES:

[1] Opt. Lasers Eng. 71, 20–32 (2015).
[2] Opt. Lasers Eng. 135, 106187 (2020).
[3] Light Sci. Appl. 11(1), 154 (2022).
[4] Opt. Lasers Eng. 128, 106003 (2020).
[5] PhotoniX 2(1), 19 (2021).
[6] Opt. Lasers Eng. 109, 23–59 (2018).
[7] Opt. Lasers Eng. 85, 84–103 (2016)
[8] Meas. Sci. Technol. 29(12), 122001 (2018).
[9] Opt. Lasers Eng. 102, 70–91 (2018).
[10] Optica 8(12), 1507–1510 (2021).
[11] Opt. Express 30(3), 3424–3442 (2022).
[12] Opt. Lett. 45(7), 1842 (2020).

ICO VP Gilles Pauliat chairs the Prize Committee

"Smart Computational Light Microscopes" developed by Prof. Chao Zuo's research group from Smart Computational Imaging Laboratory (www.scilaboratory.com) of NJUST (China).



3D shape and trajectory tracking of a bullet fired from an airgun based on Micro-Fourier transform profilometry from [9]

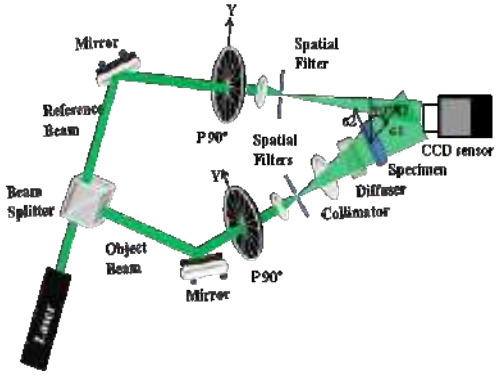
Galileo Galilei Medal Award to C.S. Narayanamurthy

Prof. Narayanamurthy works at the Indian Institute of Space Science & Technology

Prof . Narayanamurthy made pioneering contributions to the field of shearography.

After returning from his postdoc in the Imperial College, London, U.K, Prof. Narayanamurthy set-up the laser Optics laboratory at Bhavnagar University, Bhavnagar, Gujarat, India, where he developed new collimation testing techniques. In 1996, he moved to the Applied Physics Department, The M S University of Baroda, Vadodara, Gujarat, India to work on photorefractive applied optics and digital holography, developing techniques for the first time in India for measuring diffusion coefficients of liquids using interferometry.

In 2006, at the Insitut Fur Technishe Optik, Germany Prof. Narayanamurthy developed a digital holographic Polariscope. In 2007, he joined the Indian Institute of Space Science and Technology (IIST) and developed wavefront sensing and digital holographic techniques for Ritchey-Chretein telescopes that were part of a satellite project of the Indian Space Research Organization (ISRO), for which he also worked on improved electro-optical systems and digital holographic techniques for Non-Destructive Testing of aerospace structures. Simultaneously, at IIST novel Shack-Hartmann Sensors were developed using the concept of twist parameter of the beam. Further, Prof. Narayanamurthy and his group implemented a new vectorial shearing interferometer for sensing turbulence impacted beams, with the advantage of using either laser or LED sources. The group also has proved the insensitiveness of turbulence impacted Laguerre Gaussian beams so that such engineered beams can be useful in free space optical communications.



Experimental design of a polariscope to measure the stresses of non-birefringent materials from J Mod Opt, 66, 8, 817-828 (2019).

ICO VP Prof. Natalya Kundikova chairs the Award Committee

Contacts

Forthcoming events with ICO participation

Below is a list of forthcoming events with ICO participation. For further information, visit their official websites listed below.

11-15 September 2023
EOSAM 2023. Annual Meeting of the European Optical Society

Dijon, France
Contact: Elina Koistinen
elina@europeanoptics.org
https://europeanoptics.org

27-31 March 2023
RIAO/OPTILAS Iberoamerican Optics Meeting/XIV Latinamerican Meeting on Optics Lasers and Applications
Costa Rica
Contact: Prof Manuel Costa
president@optica.pt
https://riao-optilas-2022.org

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