ZPH TECH 2023

Talks on Photonics Science and Technology @ IZTECH

October 23-24

Izmir Institute of Technology, Urla/IZMIR

ZPH TECH 2023

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Fotonik Bölümü

Department of Photonics

Prof. Dr. Canan VARLIKLI

Head of IZTECH Department of Photonics

Dear All,

We - the IZTECH Izmir Institute of Technology Photonics family - are honored for organizing the Talks on Photonics Science and Technologies @IZTECH (IZPHOTECH) for the second time this year. We, IZTECH-Department of Photonics, IZTECH Optics and Photonics, IEEE Photonics student chapters, are organizing IZPHOTECH to celebrate the World Photonics Day with the contributions of IEEE Photonics Society Turkey Chapter and OPTICA (formerly OSA). I would like to thank our students for their dedication and hard work and the mentioned international organizations for their financial support.

As the citizens of the world, we all are living the nanotechnology evolution, the century of photon related technologies, and this year, 2023, as the ones living in Türkiye, we are full of joy and pride, and we express our gratitude, responsibility and excitement for the 100th anniversary of our country's foundation.

As a woman living on these lands, Türkiye, I am grateful to our Republic for providing me the opportunity to present my skills, talents, capabilities that make me happy and the skillsets that I use in my private life, available for a wider population, our next generation, students, as a university faculty member, advisor, board member, head of department,… to our future generation, regardless of gender.

I am grateful to everyone who founded our Republic and ensured that the gender equality laws that exist in our cultural life were passed on in written rules, regulations and laws, but most of all to Mustafa Kemal Atatürk, our great ancestor and the founder of the Turkish Republic, who took initiative and encouraged those around him to take the initial steps.

Throughout the İZPHOTECH'23, we will have the opportunity to listen to and overview 12 talks on valuable contributions to Photonics Science and Technology. Seven of those presentations will be in person. I would like to thank all our speakers for dedicating their most valuable assets and their valuable time to us.

I hope that these valuable speeches, which most of them will be steamed and archived on the official youtube channel of the IZTECH Optics and Photonics Student Chapter, will contribute to many Photonics enthusiasts.

Thank you…

IZPHOTECH 2023 PROGRAM

October 23, Monday

09:30 – 10:00 Opening Speeches

10:00 – 11:00 Anvar Zakhidov – *Single Layer Perovskite LEC vs Conventional Multilayer OLEDs: Memristive Ionotronic Behavior* (A. G. MacDiarmid Nanotech Institute, University of Texas at Dallas, USA; Samarkand Quantum Center, Uzbekistan)

11:00 – 12:00 Viviana Andrea Claveria – *Optical Trapping in Biomedical and Biophysics Applications* (Pontificia Universidad Catolica de Valparaiso, Chile)

12:00 – 14:00 Lunch

14:00 – 15:00 Deepak Jain – *Next Generation Optical Fibers for Light Sources and Communication* (Indian Institute of Technology Delhi, India)

15:00 – 16:00 Santosh Kumar – *Plasmon Assisted Inline Optical Fiber Sensors: Towards Healthcare Applications* (Liaocheng University, China)

16:00 – 17:00 Mohammed Elamassie – *Skies of the Future: Multi-layer Airborne Optical Wireless Backhaul Networks* (Centre of Excellence in Optical Wireless Communication Technologies, Özyeğin University, Türkiye)

17:00 – 18:00 Martin Virte – *Integrated Multi-wavelength Lasers: Design, Control and Applications* (Vrije Universiteit Brussel, Belgium)

IZPHOTECH 2023 PROGRAM

October 24, Tuesday

10:00 – 11:00 Serdar Özçelik – *Quantum Dots and Display Materials* (Izmir Institute of Technology, Türkiye)

11:00 – 12:00 Anirban Dhar – *Specialty Optical Fiber: Materials Technology and Application* (Central Glass & Ceramic Research Institute, Kolkata, India)

12:00 – 13:00 Break

13:00 – 14:00 Evren Mutlugün – *Colloidal Nanocrystals for Color-Converting and Electroluminescent LEDs* (Abdullah Gül University, Türkiye)

14:00 – 15:00 Hakan Keskin – *Sixth Sense: Inertial Navigation Systems* (ROKETSAN, Türkiye)

15:00 – 16:00 Serap Yiğen – *Emerging Display Technologies* (VESTEL, Türkiye)

16:00 – 17:00 Alper Ülkü – *Advancements and Future Prospects in FinFET Technology* (ASELSAN, Türkiye)

Anvar ZAKHIDOV

Prof. Anvar A. ZAKHIDOV is Deputy Director of UTD-NanoTech Institute, Full Professor of Physics, Affiliated Professor of Materials Science and Adjunct Professor of Chemistry. He is also visiting professor at National Research University TIIAME, Tashkent & Samarkand NU, Uzbekistan.

Earlier, Zakhidov had been working as Senior Research Scientist of Honeywell, (former Allied Signal Inc.) since March 1996. He got his Ph.D. degree in Optics in Moscow in 1981 and since that time was actively involved in scientific research in various places, including Nuclear Institute of Uzbekistan Academy of Sciences, (1983-1988), 4 years spent in Japan (as Monbusho Visiting Professor in IMS, Okazaki and Kyoto and Osaka Universities), 1.5 year in Italy (Bologna, Institute of Molecular Spectroscopy).

A. Zakhidov have been awarded internationally recognized awards and fellowships for excellence in the field of Physics and Material Science (Monbusho and NEDO (Japan), and INTAS (Europe)). So, he was recognized as "The Engineer of the Year Award" by CIE/USA in the year 2002 and got Nano 50 Award from Nanotech Briefs Magazine (2006), and the NanoVic Prize from Australia (2006), Kapitza Golden Medal for Scientific discovery (2008) and Elsevier Scopus Award 2018 as most highly cited Russian scientist in the fastest developing area of Perovskite PV.

A. Zakhidov is APS Fellow, AAAS Fellow, Academician of RAEN (Russian Academy of Natural Sciences), Foreign academician of KazNAEN): Kazakhstan Academy of Natural Sciences and a member of other various associations in the field of physics, chemistry, and materials science.

Zakhidov is also serving as a US Regional Managing Editor of International Journal of Nanoscience and in the Editorial Board of 'Molecular Materials", an international journal and edited a guest volume of Synthetic Metals. Zakhidov was and presently is a Principal Investigator in several grants on advanced materials awarded by such USA Government agencies as DARPA, NASA, DOD, DOE, AFOSR, NSF and others for total funding of over $15 M.

He has more than 400 published papers, cited more than 38500 times with Hirsh index of h=71 (by Google) and h=65 (Scopus), and 25 USA patents in the field of advanced materials, including conducting polymers, carbon nanotubes, perovskite and organic PV and LED and various other frontier materials and devices.

A. Zakhidov predicted theoretically and co-pioneered (with K. Yoshino and S. Morita) the experimental discovery of fast photo-induced charge transfer from conjugated polymers (particularly P3HT) to fullerene molecule C60 in 1991. This phenomenon is now widely used in plastic solar cells, photodetectors, and biochips.

Single Layer Perovskite LEC vs Conventional Multilayer OLEDs: Memristive Ionotronic Behavior

Conventional OLEDs and perovskite LEDs need multilayered structures: as well-known transport layers, ETL and HTL, surround the emissive layer, EML, providing effective injection of electrons and holes. The existence of intrinsically mobile ions in metal halide perovskites, such as CsPbBr3 allows the formation of dynamic p-i-n structures by self-doping and formation of electric double layers (EDL) at interfaces even in single layer devices. However, the intrinsic ions (e.g., Cs+, Pb+,

I- or Br-) migration in electric field destroys the very perovskite ionic lattice and also causes instabilities at interfaces. We have demonstrated in series of recent papers that small amounts of external ions (e.g., Li+ ions added as Li-salt) in nanocomposites of CsPbBr3 with PEO type solid electrolytes allow to create bright and effective single layer light emitting electrochemical cells (SL-LEC) without need for transport and/or injection layers. Moreover, the lifetime of such SL-LEDs is increased significantly since external Li ions protect ionic lattice by differentiated ionic migration. Importantly additional interesting properties can be achieved, such as reconfigurability of LEC to turning dynamically into PV solar cells. Indeed SL-LEC behaves as light emitting memristor, showing memory effects and in my talk, I will describe the various aspects of ionotronic behavior, when drift of external and internal ions creates hysteretic behavior similar to that of memristive diodes. We have studied the dynamics of ionic migration using various techniques and I will discuss the prospects of memristive ionotronics leading to formation of analogs of artificial synapses in neural networks and their perspectives for future nonlinear photonic devices.

Viviana CLAVERÍA

Dr. Viviana Clavería is assistant professor in the Complex System Group of the Physics Institute at the Pontifical Catholic University of Valparaíso, PUCV, Chile.

Dr. Clavería is as well an energetic physicist engineering with a Ph.D. in Physics from the Saarland University in Germany and the University of Montpellier in France, where she worked in biophysics characterizing the blood flow in both health and sickle cell anemia by using microfluidics and optical techniques. She has broad and deep experience working on scientific research. Her areas of expertise include biophysics, biofluids, the development of microfluidic devices for research and transfer technology projects for applied science, currently leading the Biophysics and Medical Devices lab at PUCV. She also has wide experience in data analysis, image analysis, and machine-learning tools. She is also a passionate oil painter, and author of scientific stories for kids.

Optical Trapping in Biomedical and Biophysics Applications

Many biomedical and biophysical investigations require to move, stretch or mechanically probe a biological sample by exerting controlled forces in a non-contact way. Optical trapping of microscopic samples has been on the rise in recent years being a versatile technique for optical manipulation of biological samples at different length scales that can be combined with other measurement techniques for a better and/or more controlled experiment. In this webinar, I will be presenting the physical laws, advantages, disadvantages, and limitations of optical tweezers that make them suitable (or not) for a variety of applications in biomedicine and biophysics.

Deepak JAIN

Deepak Jain is an Assistant Professor at the Optics & Photonics Center (OPC) of the Indian Institute of Technology Delhi. Before this, He was an Assistant Professor at the Electrical Engineering department of the Indian Institute of Technology Bombay, a University Research Fellow at the University of Sydney, and a Hans Christian Oersted and Marie-Curie Research Fellow at the Technical University of Denmark. He obtained his Ph.D. from the Optoelectronics Research Center, University of Southampton, UK, and his MTech from the Indian Institute of Technology Kanpur. His area of interest revolves around light and its applications, space, and technology transformation from academia to industry.

He is a co-founder of BrahmaSens Technologies, a Delhi-based Sensor and laser company, SpecPhotonics, an Adelaide-based specialty optical fiber company, and was an early co-founder of NORBLIS, a Danish broadband laser company. He has more than 70 publications, including 27 journal publications and several invited conference papers. He is a chair of Optica's Optical Fiber Modelling and Fabrication group and an Optica Ambassador. He is also a senior member of Optica and IEEE.

Next Generation Optical Fibers for Light Sources and Communication

The specialty optical fibers have different geometrical designs and refractive index profiles than conventional step-index optical fibers. These specialty optical fibers have dramatically revolutionized the functionality of optical fibers securing several applications in space-division multiplexing, high-power narrow linewidth lasers, broadband supercontinuum sources, and sensors. In this talk, I will discuss novel specialty optical fibers which have emerged in the last decade especially for communication and high-power fiber lasers, including a few of my current inventions.

Santosh KUMAR

Santosh Kumar holds a Ph.D. degree from IIT (ISM) Dhanbad, India and currently serves as a Professor at Liaocheng University, China. He has been recognized as one of the world's top 2% scientists by Stanford University in both 2020 and 2022. With extensive research experience, he has supervised twelve M.Tech. dissertations and six Ph.D. candidates. His contributions to the field include the publication of over 310 research articles in prestigious SCI journals and conferences, with more than 5400 citations and an h-index of 42. His work has been featured in renowned journals such as Biosensors and Bioelectronics, Biosensors, Journal of Lightwave Technology, Optics Express, Optics Letters, Applied Physics Letters, and various IEEE Transactions. Santosh Kumar has presented his research at conferences in India, China, Belgium, and the USA, demonstrating his global reach. Dr. Kumar is the author of two scholarly books, "2D Materials for Surface Plasmon Resonance-Based Sensors" (CRC Press, 2021) and "Optical Fiber-Based Plasmonic Biosensors: Trends, Techniques, and Applications" (CRC Press, 2022). He recently filed a patent application for his groundbreaking optical fiber sensing technology. As a highly regarded expert, he has reviewed over 1800 manuscripts for esteemed SCI journals published by IEEE, Elsevier, Springer, OPTICA, SPIE, and Nature. Santosh Kumar's professional achievements include being a Fellow of SPIE, a life fellow member of the Optical Society of India (OSI), and a Senior Member of IEEE, OPTICA, and SPIE. He also serves as an OPTICA Traveling Lecturer. Through fruitful collaborations with renowned universities in India, China, Portugal, Brazil, and Italy, he conducts cutting-edge scientific research. With expertise in electronics, communications engineering, and physics, his research focuses on WaveFlex biosensors, fiber optic sensors, photonics and plasmonic devices, nano and biophotonics, waveguides, interferometers, and internet of things. Recognizing his contributions, Santosh Kumar has been appointed as the Chair of the Optica Optical Biosensor Technical Group and as an Associate Editor for IEEE Sensors Journal, IEEE Internet of Things, and Biomedical Optics Express. Dr. Santosh Kumar's contributions extend beyond academia. He is currently a Shandong Provincial Distinguished Foreign Expert by the Department of Science and Technology of Shandong Province, China.

Plasmon Assisted Inline Optical Fiber Sensors: Towards Healthcare Applications

We have recently developed a variety of optical fiber-based biosensors to detect and measure biomolecules such as creatinine, alanine aminotransferase, cholesterol, glucose, dopamine, ascorbic acid, L-cysteine, p-cresol, collagen, and bacteria [1-4]. We have fabricated the sensors with a variety of special fibres, including tapered optical fibres, fibre ball structures, single mode-multimode mismatch fibres, hollow-core fibres, and photosensitive fibres, among others. A hydrogen-oxygen flame technique and a plasma technique were used to fabricate a tapered fibre structure. An advanced fusion splicer machine was used to develop the remaining fiber sensor structures. Various nanoparticles, such as gold nanoparticles, silver nanoparticles, graphene oxide, copper oxide nanoparticles, copper oxide nanoflower, zinc oxide nanoparticles, molybdenum disulfide, and others, were used to improve the performance of sensors. Following that, several specific enzymes were used to incorporate the biosensors' selectivity property. For the characterization of sensor structure, we used the high-resolution transmission electron microscope (HR-TEM), scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), UV-Visible spectrophotometer, and atomic force microscopy (AFM). The sensor is based on the phenomenon of localised surface plasmon resonance, that is caused by nanoparticles being coated over the fibre structure. In general, I'll talk about the fabrication and development of optical fiber-based WaveFlex sensors for health monitoring applications and everyday use in our daily life.

Mohammed ELAMASSIE

Dr. Mohammed Elamassie received the B.Sc. and M.Sc. degrees in electrical engineering from the Islamic University of Gaza, Gaza Strip, Palestine, in 2006 and 2011, respectively, and the Ph.D. degree in electrical and electronics engineering from Özyeğin University, Istanbul, Turkey, in 2020. He is currently an Assistant Professor at Özyeğin University, Istanbul, Turkey. He also serves as the Executive Co-Director of the Centre of Excellence in Optical Wireless Communication Technologies (OKATEM).

Dr. Elamassie's research interests are in the broad area of optical wireless communications. Specific topics include underwater visible light communication, vehicular visible light communications, airborne free space optical communication, atmospheric channel modeling, diversity techniques for fading mitigation, and MIMO communications. He has authored over 50 publications in reputable journals and conferences on these topics, with 900+ Google Scholar Citations and an H-index of 16.

Dr. Elamassie received the Best Paper Award at the IEEE International Black Sea Conference on Communications and Networking 2019. He is also the recipient of the 2020 IEEE Turkey Doctoral Dissertation Award. He is actively engaged in the academic community. He holds senior memberships in both IEEE and Optica and is an Optica Travelling Lecturer. In addition, he serves as a Review Editor on the Editorial Boards of Frontiers in Communications and Networks' specialty sections 'Non-Conventional Communications and Networks' and 'Wireless Communications.

Skies of the Future: Multi-layer Airborne Optical Wireless Backhaul Networks

The implementation of non-terrestrial networks (NTNs) is anticipated to establish truly global coverage for 6G and subsequent generations of wireless technology. With 40% of the world population still remaining unconnected or under-connected, there is a pressing need to harness NTNs to bridge the digital divide. NTNs comprise various technologies, including High-Altitude Platform Stations (HAPSs), Satellites (GEO, MEO, LEO), and Unmanned Aerial Vehicles (UAVs). Progress in autonomous avionics and lightweight composite materials has positioned HAPSs as feasible NTN nodes for future networks, alongside rotary wing unmanned aerial vehicles (UAVs). In the context of advanced wireless technologies like 6G and beyond, the goal is to achieve a smooth integration of NTN nodes with terrestrial networks. Presently, there are instances of isolated deployment examples, including, Google Loon, Nokia F-Cell, AT&T Tethered Flying COW drone, AT&T Tethered Flying Cell on Wing (COW), LEO mega-constellations, and Turkcell -Dronecell. This talk focuses on the overall design of a multi-layer airborne backhaul network in which HAPSs and rotary-wing UAVs are used to establish free space optical (FSO) backhaul connections with ground-based stations. While HAPS fleets operate in circular patterns at stratospheric altitudes to provide extensive coverage, rotary-wing UAVs operate at medium and lower altitudes, complementing the HAPSs' coverage. The aerial backhaul architecture must be carefully designed to ensure uninterrupted connectivity with the ground-based stations, eliminating any gaps in coverage. The talk includes a systematic approach for designing FSO-based airborne backhaul systems, outlining the process of determining the appropriate number of layers, HAPS tracks, HAPS units per track, the number of UAVs at lower altitudes, the operating altitude for middle-layer UAVs, and the number of laser sources per airborne node based on a given coverage area.

Martin VIRTE

Martin Virte is a professor with the Brussels Photonics (B-PHOT) group of the Vrije Universiteit Brussel (VUB) in Belgium. Born in France, he graduated as an engineer from the French "Grande Ecole" Supélec (now CentraleSupélec) in 2011. He then received his PhD in engineering in 2014 with the highest honours from the Vrije Universiteit Brussels (VUB, Brussels, Belgium) and Supélec as part of a joint PhD program. In 2015, he received a 3-year post-doctoral fellowship from the Research Foundation – Flanders (FWO) to pursue his research work at VUB. He then became a research professor at the VUB three years later. Then, in 2020, he received a prestigious Starting Grant of 1.5 MEuros from the European Research Council (ERC) to explore how multi-wavelength lasers can be exploited for all-optical signal processing of mm-wave and THz signal. He became professor (tenure track) at the Vrije Universiteit Brussel the same year.
Martin's work initially focused on the nonlinear dynamics of semiconductor lasers from its fundamental aspect to potential applications. While this topic is still a central focus point of his current research, Martin is also exploring new facets of the problem including the design of novel laser systems on Photonic Integrated Circuits, such as Multi-Wavelength Lasers, the impact of laser dynamics in the context of fiber sensing, and the use of laser dynamics for all-optical processing.

Integrated Multi-wavelength Lasers: Design, Control and Applications

Multi-wavelength lasers have emerged as a promising solution for a range of applications: from sensing to high-frequency signal generation or all-optical processing. For instance, they are an appealing solution to generate mm-wave or THz signals: besides the reduced footprint or the lack of required alignment, the coupling between modes leads to lower noise level. However, lasing is still a "winner takes it all" process, thus simultaneous emission at multiple wavelengths can be a challenging target to reach. A rather careful design or a precise control mechanism are typically required.
In this talk, I will briefly review demonstrated schemes to implement multi-wavelength lasers on Photonic ICs, with a particular focus on laser designs compatible with (active) generic foundry platforms. I will discuss the difficult trade-off between flexibility, tunability and stability, and highlight the approach we chose relying on a phase-controlled optical feedback loop. Finally, I will present some of our recent results exploiting such multi-wavelength lasers for new applications such as spectral multiplication of frequency combs and wavelength conversion.

Serdar ÖZÇELİK

Serdar Özçelik received B.Eng. and M.Eng. degrees in engineering physics at Ankara University, Turkey, in 1986 and 1988 respectively. While he was pursuing a PhD degree in engineering physics, he was selected by TUBITAK for NATO Science Scholarship to earn PhD degree. He earned his PhD degree in chemistry at City University of New York in 1996. He worked as Asst. Prof. at Bilkent University between 1997-2002. As a visiting scientist, he worked in Cellular Observatory at Pacific Northwest National Laboratory, WA, USA, between 2002-2004. Currently he is a professor of chemistry at Izmir Institute of Technology (IYTE) where he served as Dean of Faculty of Science from 2011 to 2018. He established two totally new departments at IYTE: Department of Photonics (served as founding chairman in 2015-2018) and Department of Neuroscience; both also first in Turkey. He also served as chairman of Department of Chemistry from 2010 to 2011. Prof. Özçelik brought in several funds through many research projects and established several research laboratories. Prof. Özçelik is developing chemistry and device physics of quantum dots for displays and infrared cameras and light emitting nanomaterials for early diagnostics of diseases (particularly cancer) and possible new therapeutics. Prof. Özçelik recently directed a research study at Stanford Medical School, supported by Fulbright Commission, focused on enhancing efficacy of radiotherapy using targeted gold nanoparticles located in cell nucleus.

Quantum Dots and Display Materials

Quantum dot is a class of nanoscale optical material having superior properties compared to common light emitting material due to quantum confinement effects. This confinement precisely adjusts emission wavelength of the quantum dots having same chemical composition. Quantum dots found its way as emitting material for displays particularly televisions. Early utilization of the quantum dots excited by blue light emitting diodes was generation of two-colored emission in a polymeric film to produce white light. Recent effort is focused on fabricating quantum dot based electroluminescent display to eliminate color filters and to reduce energy requirement. In this talk, I will cover chemistry of quantum dots as display materials.

Anirban DHAR

Dr. Anirban Dhar is a Principal Scientist working at the Fiber Optics & Photonics Division of CSIR-Central Glass Ceramic Research Institute, Kolkata, and Associate Professor of Chemical Science at AcSIR, India. After obtaining his Ph.D. degree from Jadavpur University in 2008, he moved to the Institute of Photonics Electronics, ASCR v.v.i Czech Republic in 2009 and then to Optoelectronics Research Center, University of Southampton, UK, in 2010 before joining CSIR-CGCRI as a Scientist in 2012. He has developed different kinds of specialty optical fiber, including fibers that demonstrate the world's 1st multimode amplifier, the use of novel alternate dopants for RE-doped optical fiber, and active GRIN fiber to improve fiber laser performance one step ahead. His research interest includes the development of specialty optical fiber of various types to develop fiber-based amplifiers, high-power lasers, and sensors. He has published more than 110 SCI Journal publications, 4 book chapters, holds 4 US patents, and delivered several Invited talks in India and abroad. He is the recipient of the Young Scientist Award from the Material Research Society of India in 2006 and a Senior member award from the Optical Society of America, USA in 2020.

Specialty Optical Fiber: Materials, Technology and Application

Optical fiber is one of the important discoveries that has revolutionized the progress of modern civilization. Thanks to optical fibers, and several advantages, including tremendous bandwidth, excellent security, flexibility, etc., the optical fiber has replaced the Cu-cable in the present communication system. On top of that, a piece of specialty optical fiber doped with different active dopants has a plethora of applications beyond communication and has become an indispensable part of our daily life, including industrial applications (cutting, marking, drilling, etc.) medical domain (surgery, diagnosis, imaging, etc.), strategic sectors (laser-based weapon, detection, LiDAR, etc.) beside basic high-end research. To cater to the applications area further as well as to improve the performance to the next level, tailoring of waveguide design, selection of novel glass composition, improved fabrication technique, and sophisticated material/optical characterization need continuous research effort along with high-end engineering to develop a usable product. The lecture will cover an overview of Specialty Optical Fiber, starting from its design, material selection, fabrication technology, and challenges ahead.

Evren MUTLUGÜN

Prof. Evren Mutlugün earned his Bachelor of Science degree in Physics from Middle East Technical University in 2005. He subsequently pursued his Master of Science and Ph.D. degrees, both from Bilkent University's Physics Department in 2007 and 2012, respectively.

Following the completion of his academic qualifications, prior to his appointment as a faculty member of Electrical-Electronics Engineering at Abdullah Gül University, Türkiye (AGU) in 2014, he served as a National Research Foundation Competitive Research Programme (NRF-CRP) research fellow at Nanyang Technological University, Singapore, from 2012 to 2014.

Prof. Mutlugün's primary research focus centers on colloidal nanocrystal-based exciton harvesting systems for innovative optoelectronics. Among his many accolades in the field, he was awarded the 2022 TUBITAK (The Scientific and Technological Research Council of Türkiye) Incentive Award and the 2017 Turkish Academy of Sciences Outstanding Young Scientist Award. Notably, he was elected as a member of the Global Young Academy in 2016 and received the first prize in a competition organized by the Royal Academy of Engineering in the UK in 2015, during which he presented his tech-business idea.

Throughout his career, Prof. Mutlugün has delivered numerous invited talks, co-authored numerous conference papers, and published over 60 articles in high-ranking journals in the field of study. Additionally, he is concurrently serving as the director of the technology company that he founded.

Colloidal Nanocrystals for Color-Converting and Electroluminescent LEDs

Colloidal nanocrystals, also named artificial atoms, are promising agents for future optoelectronics owing to their high efficiency, spectral purity, and stability. This talk will highlight our recent advancements in advanced materials with substantial implications in color conversion and electroluminescent light emitting diodes (LEDs), including our recent effort for high quality displays.

Hakan KESKİN

Dr. Hakan Keskin received his B.S. and M.Sc. degrees in the Department of Physics from Middle East Technical University. During his graduate studies, he was a research assistant at the METU THz Research Laboratory in the field of THz time-domain spectroscopy, ultrafast lasers, and rare earth-doped fiber lasers.

He completed his Ph.D. in 2023. In his Ph.D. dissertation research, he developed a novel all-fiber optic gyroscope operating at 1 µm wavelength with high sensitivity.

Since 2016, he has working as a technical product owner at Roketsan. His studies mainly focus on inertial measurement units, fiber optic gyroscopes, ring laser gyroscopes, quartz pendulous accelerometers and electro-optic systems. He is an inventor of one registered national patent on an electro-optic device. Currently he is leading a multi-disciplinary team developing inertial measurement units.

Sixth Sense: Inertial Navigation Systems

Inertial navigation systems function as a sixth sense for human-designed technical platforms. In situations where communication and interaction with the surroundings are not possible, sensors based on the principles of inertial measurement help platforms determine their position and direction. This principle is highly crucial, especially in military applications, such as in GNSS-denied environments. In this presentation, we will emphasize the importance of inertial measurement units and inertial sensors. Later, we will investigate inertial sensors, especially optical-based sensors. We will also present the inertial systems and sensors developed and produced by Roketsan, including our current R&D projects.

Serap YİĞEN

Serap Yiğen received her B.Sc. degree in Physics from Izmir Institute of Technology in 2008. She went on to complete her M.Sc. and Ph.D. in Physics from Concordia University, Canada in 2011 and 2015, respectively. During her time as a graduate student, she conducted research in the Quantum Nanoelectronics Laboratory, focusing on low-dimensional systems and studying the electronic and thermal properties of graphene. After completing her Ph.D., she returned to her home country and received support from the TÜBİTAK-2232 Reintegration Research Fellowship Program for a duration of 2 years. Following this, she continued her research activities as a postdoctoral fellow, working on collaborative projects between academia and industry. Her research involved applied physics, specifically thin film deposition and characterization techniques, device applications, and optical filter design. Additionally, she worked as a part-time lecturer at Izmir University of Economics. Currently, she is employed at VESTEL Electronics R&D Center as a design architect for visual solutions products. In addition to her role as a design architect, she also leads and manages technology development projects. Her current research focuses on exploring novel optical materials, their applications in display technologies, and advancing optical design techniques.

Emerging Display Technologies

In recent years, display technologies have experienced remarkable advancements, transforming the way we engage with visual information. The increasing demand for larger displays, improved image quality, and reduced power consumption has spurred the emergence of innovative approaches in this field. This talk aims to provide an introduction to the current state-of-the-art display technologies and market trends in advanced displays. It will offer an overview of the various emerging display technologies, highlighting their key features and the challenges they present. By exploring these advancements, this talk seeks to provide valuable insights into the evolving landscape of display technologies and their potential impact on enhancing visual experiences.

Alper ÜLKÜ

Alper ÜLKÜ received his B.Sc. in Electrical Engineering from Middle East Technical University and M.Sc. in Electrical Engineering from Gazi University, in 1991 and 1999. Currently he is a Ph.D. candidate in Materials Science and Engineering at Gebze Technical University and works as Team Leader / Chief Engineer of Display Technology in ASELSAN Microelectronics Guidance and Electro-Optics Business Sector, Turkey. His research interests include the thin film transistors, display materials, display optics, radiometry and photometry, display ruggedization process and AMOLED device fabrication. He occasionally lectures on the technical elective course Optical Display Technology and Design course in Ankara and Karadeniz Technical Universities.

Advancements and Future Prospects in FinFET Technology

FinFET technology has emerged as a game-changing solution to address the performance and scalability challenges faced by traditional planar MOSFETs. With continuous advancements, FinFETs have evolved to offer enhanced device performance, reduced power consumption, and improved integration capabilities. This talk explores the latest developments in FinFET technology, highlighting key advancements and their impact on the semiconductor industry. We begin with an overview of the historical background of thin-film transistors (TFTs) and their limitations, which led to the development of FinFETs. We discuss the motivation behind transitioning to FinFETs, including the need for improved control over short channel effects and reduced leakage currents. Subsequently we lay fundamental concepts of FinFET technology, explaining the unique structure of FinFETs and their advantages over traditional planar devices. We cover critical aspects such as the fin height, fin width, and gate length, which significantly influence device performance and scalability. The presentation highlights the role of high-k dielectrics in FinFETs to mitigate short channel effects and enhance gate control. It explores the adoption of innovative materials, such as ε-functionally graded dielectrics (ε-FGMs) and their potential to further improve device performance through tailored electrical properties. We also discuss the various challenges associated with FinFET technology, including process integration, variability, and power dissipation. It presents recent developments in addressing these challenges, such as advanced fabrication techniques, variability modeling, and power optimization strategies. We finalize with future of FinFET technology. We emphasize ongoing research efforts in areas such as device scaling, novel materials, and device architectures, which aim to push the boundaries of semiconductor technology and drive the development of next generation nanoelectronics.

This comprehensive overview of the latest developments in FinFET technology provides valuable insights into the advancements and challenges in the field. It may serve as a foundation for researchers, engineers, and industry professionals to stay aware of the current state of FinFET technology and its potential for shaping the future of semiconductor devices.

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Talks on Photonics Science and Technology @ IZTECH

2023

IZPHOTECH 2023 TEAM

Prof. Dr. Canan VARLIKLI
Head of IZTECH Department of Photonics
Advisor of IZTECH Optics and Photonics Society

Assoc. Prof. Dr. Hasan GÖKTAŞ
IEEE Photonics & SSCS Society Turkey Chapter Chair

Sena KAVAS
President of IZTECH Optics and Photonics Society

Sümeyye Meryem ÇÖPÜR
President of IEEE Photonics IZTECH Student Chapter

Umut Baran GÜNDÜZ
Former President of IZTECH Optics and Photonics Society

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