The IUSL Report

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IUSL has completed 37 Years of Operation as of December 31, 2019

Photonics Training Program of High School and Under Graduate, Summer 2019


Allison Zhang


Mihiri Fernando


Brian Hettiarachchi


Josh Abramson


Jia Hui Weng


Anna Jacobowitz


TongRui Zhang


Lana Levine

Investigation of Spontaneous Raman Scattering using Complex Vortex Vector Beams

Allison Zhang
William A. Shine Great Neck South H.S

In this study, the effect of complex vortex vector beams on spontaneous and resonant Raman in neat methanol and acetone, and beta-carotene in methanol and beta-carotene in acetone solutions were observed. There were no significant changes seen in methanol or acetone, and very minute differences were seen in the beta-carotene in acetone solution. However, significant changes in the ratio of the methanol peaks to beta-carotene peaks were seen in the beta-carotene in methanol solution, with significant differences in the 10^-3M concentration. Our data suggests that the complex vortex vector beams ignited an energy transfer process that resulted in difference in spectra in beta-carotene in methanol and beta-carotene in acetone.

Optical Properties of Dura Mater

Mihiri Fernando
Cheshire High School, CT

Dura mater is a thick membrane made of dense irregular connective tissue that surrounds the brain and spinal cord. It is the outermost of the three layers of membranes that protect the central nervous system. Dura mater is made up of strong, uneven, collagenous fibers. The purpose of this experiment was to analyze the optical properties of Dura Mater Tissue using absorption spectroscopy (Cary 500), Raman spectroscopy (IDR-Micro 532), and fluorescence spectroscopy (LS-50). Elements of collagen, flavins, elastin, NADH, and porphyrin were found in the Dura Mater Tissue.

CW-SRS Imaging for Beta- Carotene and Chicken Tissue

Brian Hettiarachchi
Rochester Institute of Technology (UG)

Stimulated Ramen Scattering (SRS) gain in biological tissues and imaging can greatly improve on and reduce the cost of compact diode laser-based SRS microscopes. SRS occurs due to nonlinear interactions between incident photons and vibrations in molecules. An investigation was conducted using a setup consisting of a pump beam and a stokes beam to quantify the SRS gain and loss for Beta-carotene in methanol and chicken fat. It was found that there is a consistent gain and loss in the stokes and pump signal respectively for the chicken fat. The gain and loss in the Beta-Carotene in methanol/acetone however was not as consistent.

Properties of Spinach

Josh Abramson
Riverdale Country School

Spectroscopy is an important field essential for discovering the optical properties of various materials. Running spectroscopic experiments on biological materials is useful for identifying certain characteristics of the materials. This study aims to identify many of the optical properties relevant to spinach. The main methods for accomplishing this include running multiple samples of spinach through Raman, Fluorescence, and Absorption spectrometers. The data from these tests will be graphed and analyzed using origin. We will also refer to references and other tests to identify what causes certain peaks in the graphs. The main observations include the discovery of beta carotene and other carotenoids in the structure of spinach. Chlorophyll is also identified in spinach and some peaks are labeled

Optical Properties of Dura Mater

Jia Hui Weng
City College of New York

Understanding the optical properties of Dura Mater means we can apply different optical procedures on Dura Mater. In our lab we used Raman Spectroscopy, Fluorescence and Absorption to study the optical properties of Dura Mater. Our Dura Mater sample came from Columbia University, and it was fresh as of June 19, 2019. According to our references, we believe that the Raman spectra should show peaks of collagen at 854cm-1, 938cm-1 [6] and another peak at 1450cm 1 [8] in our Figures 10, 11, and 12 we see roughly these peaks. For fluorescence we see that there is no Porphine in our sample because there are no peaks at 613nm. While for Absorption we found peaks at around 1930nm and 1450nm, but these have decreased in intensity after we dried it on a hot plate. We expect these peaks to disappear completely as we'll be using Drierite to dry the Dura Mater next. Our next step for Raman is to run it with a different laser at 514nm and 488nm, hopefully confirming our results from our 532nm laser raman setup. As for fluorescence we will have to identify what makes up these peaks and do more runs using a set range instead of changing it every run.

Exploring the Spectroscopic Differences between Table Salt and Celery Salt using Resonance Raman Spectroscopy, Absorbance Spectroscopy and Fluorescence Spectroscopy

Anna Jacobowitz
Phillips Exeter Academy, NH

This study aims to use resonance Raman scattering in conjunction with absorption and native florescence emission spectrometry to understand the biomolecular structural similarities and differences between table salt and celery salt. Celery (Apium graveolens) has a chemical composition of $C_{26}H_{14}F_2N_2O_4$, Whilst table salt is NaCl. How are their chemical composition and biomolecular functions seen through RR spectroscopy, absorption spectrophotometry and fluorescence spectrophotometry? After a preliminary literature investigation, we believe the IUSL study to be the first known exploration of celery salt photochemistry.

Interference Pattern of Double-slit via CW and Femtosecond Lasers

TongRui Zhang
The Experimental High School

The purpose of this experiment is to recreate Young's Double Slit Experiment with a 7femtoseconds laser using a continuous wave (CW) and femtoseconds mode. We will highlight the differences between the interference patterns and fringe image produced by the CW and Femtosecond laser. Lastly, with the Femtosecond Mode, we will find the distance between bright spots or fringes.

OAM and the Padgett Gadget

Lana Levine
Oceanside High School

The research focused a new type of spectrometer based on orbital angular momentum (OAM) Sorter Analyzer instead of a conventual spectrometer based on wavelength. Light beams from a laser offer special beams of light which has wave fronts that twist with orbital angular momentum, these have OAM modes. denoted as L, The L-value of a helically phased light beam is defined as the number of orbits or twists a photon goes through within one wavelength well define OAM, say with L=1. As the beam travels through a material such as glucose, quartz along optical axis or the brain tissue with the beam with L=1 or L=0 will picked up additional amount of OAM L from the Ls in the sample. The proposed OAM spectrometer Sorter will display the Ls values, the sorter would separate these beams based on this L-value. A He Ne laser was used to emit a coherent beam that would be focused into material and coupled into the mode sorter. The sorter splits the beam into L, first, into a hemispherical beam, and then linear. The split beam would then be projected onto an CCD array. Preliminary results showed the concept works and more work is needed to prove outcome from real sample of Glucose, quartz and brain tissue to obtain the OAM from the samples" L The concept needs with more measurements to make a real new device. This OAM Sorter can have many applications from medical diagnosis in a clinical setting to improving bandwidth speed in communications.

HIGHLIGHTS – Publications

Publications:

Optical Biopsy identification and grading of gliomas using ladel-free visible resonace Raman Spectroscopy, Journal of Biomedical Optics, Yan Zhou, Cheng-Hui Liu, Binlin Wu, Xinguang Yu, Gangge. Cheng, Ke Zhu, Kai Wang, Chunyuan Zhang Mingyue Zhao, Rui Zong, Lin Zhang, Lingyan shi, RobertAlfano, (2019), doi: 10.1117/1.JBO.24.9.095001.

Majorana Vortex Photons a Form of Entangled Photons Propagation through Brain tissue, Journal of Biophotonics, 2019 Robert Alfano, Sandra Mamani, Lingyan Shi, Daniel Nolan. Doi:10.1002/jbio.201900036.

Twisted light transfers OAM and SAM to electrons in a GaAs photocathode, Robert Alfano, Laura A. Sordillo, Sandra Mamani, Mikhail Sharonov. Proc. SPIE 10935, complex Light and optical Forces XIII, 109351P (1st March 2019), doi: 10.1117/12.2514646

Alzheimer's disease: Label-free florescence showa increases in indoleamine 2, 3-dioxygenase (IDO) or tryptophan 2, 3-dioxygenase (TDO) activity in affected areas of the brain. Laura A. Sordillo, Lin Zhang, Robert Alfano, Peter P. Sordillo, Proc. SPIE 10873 Optical Boipsy XVII: Toward Real-Time spectroscopic Imaging and Diagnosis, 108731C (4th March 2019); doi: 10.1117/12.2513384

Advances in medical applications using SWIR light in the wavelength range 1000 to 2500nm. Laura A. Sordillo, Lingyan Shi, Diana C. Sordillo, Peter P. Sordillo, Robert Alfano. Proc. SPIE 10873 10873 Optical Biosy XVII: Toward Real-Time spectroscopic Imaging and Diagnosis, 108730T (4th March 2019); doi 10.1117/12.2513382

The interaction of twisted Lagurre-Gaussian light with a GaAs photocathode to investigate photogenerated polarizes electrons, Laura A. Sordillo, S. Mamani, M. Sharonov, R. R. Alfano, Applied Physics Letters 114,041104(2019); https://doi.org/10.1063/1.5078503

A pilot study for distinguishing basel cell carcinoma from normal human skin tissues using visible resonance Raman Spectroscopy, Cheng-Hui-Liu, Zang, Sordillo, Beckman, Alfano, J cancer Metastasis Treat2019; 5:4. http://dx.doi.org/10.20517/2394-4722.2018.55

Combined spatial frequency spectroscopy analysis with visible resonance Raman for optical of Human brain metastases of the lung cancers, Yan Zhou, Cheng-Hui Liu, Yang Pu, Binlin Wu, Thien An Nguyen, Gangge Cheng, Lixin Zhou, Ke Zhu, Jun Chen Qingbo Li, Alfano Journal of Innovative optical Health Sciences, vol.12, No.2(2019) 1950010, DOI: 10.1142/S1793545819550010X

Grants, Patents and Book

Grants: *Alfano's Grants*

Corning Grant: BIOMEDIPHOTONICS Processes microscopes and compact devices, optical biopsy and condensed matter, #711980013

Army Grant: Compact Microparticle Random Walk Antenna for Wideband radio Frequency Communications #726770001

Army Grant: Understanding of light-based quantum processes in selected biomaterial from the brain, microtubules in selected biomaterial from the brain, microtubules and cells #473510001

Funding: *Alfano's Grants amount*

Budget: The total grants revived in 2019 was about $ 666,000

Patents: *In 2019, 7 patents were awarded to Alfano and staff*

Resonant Stimulated Raman Scattering Microscope, Robert. R Alfano, Lingyan Shi, #10,281,331, May 2019

Near Infrared Photonic Prostatoscopy Analyser, Robert R. Alfano, Wubao Wang, Yang Pu, Yury Budansky, Laura Sordillo, Guichen Tang, Jamestham, #10,362,983 B2, July 30, 2019

Rain Induced by Supercontinuum Laser Beams, Robert R. Alfano, #10,375900 B2, Aug 13,2019

OAM Microscope for edge enhancement of Biomedical and condensed matter samples and objects, Robert Alfano, Richard Gozali, Ethan Bendan, Thien-An Nguyen, Sandra Mamani, #10,401,294 B2, Sep 3, 2019

Method of Deep Tissue Imaging Using Multi-Photonic Excitation of a Fluorophore, Robert Alfano, Yang Pu, Lingyan Shi, Sebastiao Pratavieira. #10,420,471 B2, Sep 24, 2019

Resonance Raman Spectroscopy Analyser Instrument for Biomolecules in tissues and cells, Robert Alfano, Cheng-Hui Liu, #10,426,349 B2 Oct 1, 2019

Continuous Diode Laser Stimulated Raman Gain/Loss Vibratonal Microscope, Robert Alfano, Lingyan Shi, Yury Budansky, #10433731 B2, Oct 8, 2019.

Book: *Alfano edited books*

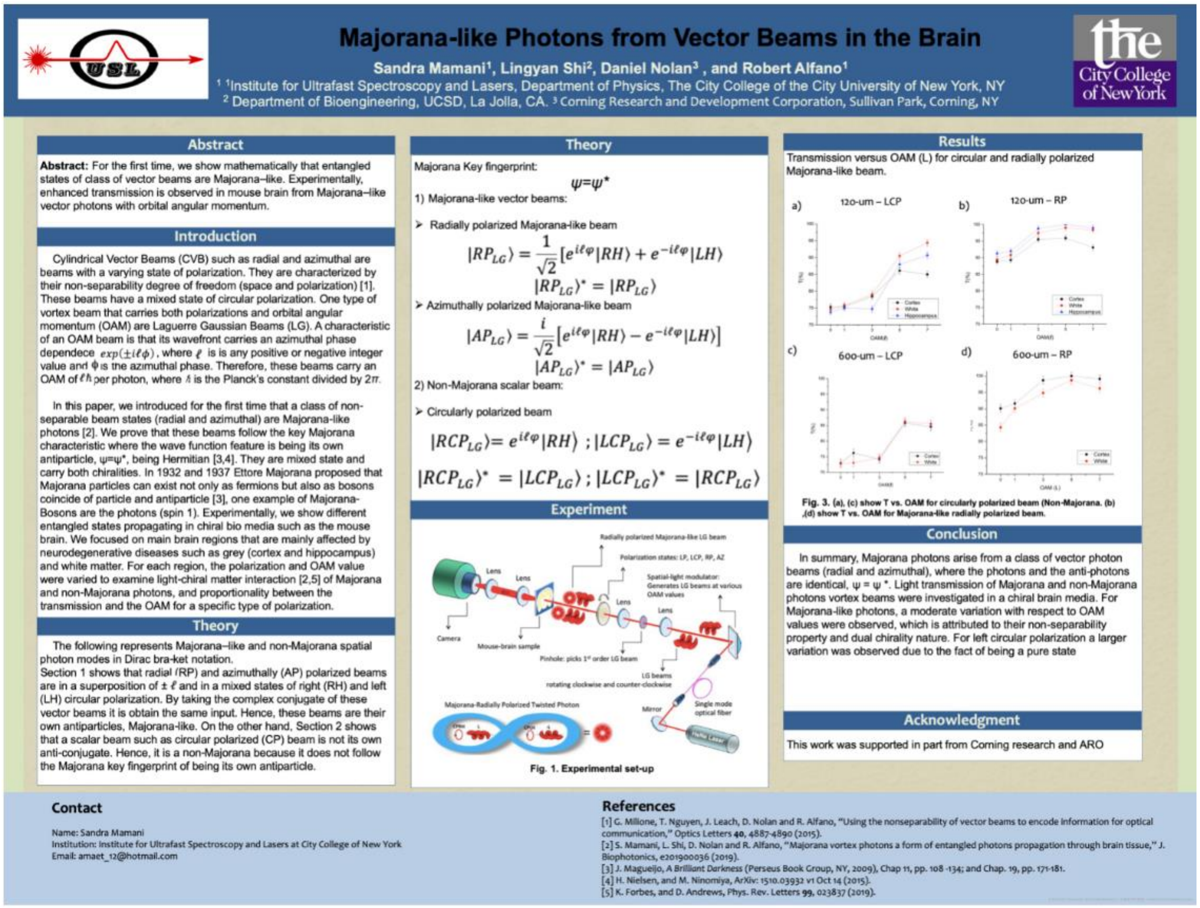
Deep Imaging in Tissue and Biomedical materials using Linear and Nonlinear Optical methods, by Lingyan Shi and Robert Alfano (2017), Pan Stanford

Neurophotonics and Biomedical Spectroscopy, Robert Alfano and Lingyan Shi (2019), Elsevier.

IUSL Student Awards

Student in the center, Sandra Mamani, won the best poster presenter at the APS 121st Topical Symposium at the Corning museum of Glass. This poster was on the experimental work with Majorana on the brain.

On November 8th, 2019, she presented, titled "Majorana-like Photons from Vector Beams in the Brain" at the 121st Topical Symposium of the American Physical Society (APS) New York State Section (Physical of the Optical Materials), where she won best poster presentation. This one-day event took place in Corning Museum of glass. The even consisted of invited talks by experts in the field of Optics. Other activities included poster sessions from undergraduate and graduate students. At the end of the poster presentations, she was called to come to the front as she was one of the best posters to be presented. Then, she was told that a cash price was going to be sent to her house. This day was definitely very rewarding as she learned new advances in the optics field, mingled with many experts in the field and was able to present her work. Link for her poster http://www.nyssaps.org/



Professor Alfano won 2019 SPIES Photonics Gold Metal Award for discovery, development and generation of white light continuum - Supercontinuum

Robert Alfano received the 2019 SPIE Gold Medal, the highest honor bestowed by the society, during the awards banquet at the SPIE Optics.

Alfano, professor of science and engineering at The City College of New York and a member of the Photonics Media advisory board, was recognized for his numerous achievements and contributions to the advancement of knowledge on the fundamental properties of materials and their interaction with light in areas of biology, condensed matter, semiconductors, tunable lasers, and biomedical optics.

Robert Alfano (r) receiving his award from SPIE President-Elect John Greivenkamp. Courtesy of SPIE

Among Alfano's most notable achievements is the discovery and subsequent development of supercontinuum light produced with an ultrashort pulsed laser. He also contributed to the field of biophotonics in the 1980s and 1990s, yielding Techniques for optical biopsy. Alfano's work on time-gated diffusive light propagation in tissue during the same time period also helped develop the fields of near-infrared spectroscopy and imaging in random media.

"Alfano is, and has long been, one of the most widely respected and influential figures in laser physics," said David Andrews, professor of physics at University of East Anglia and SPIE vice president.

Most recently, Alfano has studied structured light, another field he has made important contributions in, including the theoretical construction of a new Poincaré sphere for the total angular momentum of light. Andrew Forbes, professor of physics at University of the Witwatersand, Johannesburg, commented, "It is no small feat to reinvent a concept so ubiquitous in optics."

IUSL Research Graduate Students and Post- doctoral Resaerchers

Alfano's Group at IUSL

Laura Sordillo Completed PhD in 2019

Electrical engineering

City College of New York

Laura A. Sordillo

Laura A. Sordillo, MS (physics), MPhil (engineering), PhD (EE) is a postdoctoral researcher at Alfano's CUNY Institute for Ultrafast Spectroscopy and Lasers at the City College of New York Her research focuses on bio medical and condensed matter questions in optical science utilizing steady state and ultrafast methods in visible , short wavelength infrared and complex light for medical applications, developing devices for the assessment of neurodegenerative diseases and cancer, and studying the role of abnormal tryptophan metabolism in cancer and Alzheimer's disease. She is part of team currently investigating quantum effects in the brain and time-resolved and steady state properties of semiconductors using spin and orbital complex light. She has about 70 publications from peer reviewed journal papers, book chapters and conference proceedings and 8 patents. She was the recipient of the Kaylie Entrepreneur Award, the MSKCC-CCNY Graduate Research Award, the Grove School of Engineering Graduate Fellowship, the 2017-2018 Corning Inc. Research Fellowship, and the 2018-2019 Corning Inc. Research Fellowship.

Henry J. Meyer Current PhD student

Electrical Engineering

City College of New York

Henry J. Meyer

Henry J. Meyer is a PhD graduate student in Electrical Engineering at the Grove School of Engineering at The City College of New York (CUNY). This year he has completed his course work and passed his first qualifying exam. He is now a full-time researcher at Dr. Alfano's CUNY Institute for Ultrafast Spectroscopy and Lasers (IUSL) at City College of New York. His research focuses on nonlinear optics; Laser Filamentation, Supercontinuum Generation, Conical Emission, and various forms of Raman Scattering (Spontaneous, Resonant, and Stimulated) and Time resolved pump probe methods for decay routes of vibrations and optical phonons. He is working on applications of nonlinear optics when using Majorana-like photons. He is currently building a highly tunable pump-probe Stimulated Raman scanning microscope.

Sandra Mamani Current PhD student

Electrical Engineering

City College of New York

Sandra Mamani

Sandra Mamani was born and raised in Peru. She has obtained her Bachelors in Physics and Computer Science at Lehman College CUNY. On her senior year she decided to get research experience in the optics-photonics field. Thus, she met Dr. Alfano in

2015, where she was given the opportunity to get hands-on experience at the Institute for Ultrafast Spectroscopy and Laser (IUSL) under the supervision of Dr. Alfano. In 2017 with the help of her colleagues and supervisor, she was able to publish her first paper on how to generate and analyze vector beams, which carry complex shapes. Right now, she is currently a Ph.D. student in Electrical Engineering at Groves School at City College CUNY and researcher at IUSL. Her main area of research includes the generation and use of OAM and SAM beams for various applications such as imaging. She has also published 3 papers, which are more related to OAM. Currently she is working on an OAM imager using brain tissue, and investigating the interaction of OAM-SAM in chiral molecules. She also works on other applications that involve Majorana -like photons such as in non-linear, fiber, and free-space propagation. These special photons possess distinct properties of mixed spin and orbital state, which is more attractive for quantum computing, communications and imaging.

Shah Faisal Mazhar Current MS student

Physics Department
City College of New York

Shah Faisal Mazhar

Shah Faisal Mazhar is a research assistant of IUSL and recently accepted Master's student at Physics Department of CCNY, CUNY. Since April 2019, he has worked on experimental nonlinear techniques like Stimulated Raman Scattering (SRS), Self-Phase Modulation (SPM), Supercontinuum (SC), and Four-Wave Mixing. Recently, he presented a poster presentation at the APS NYSS Symposium 2019 on his research on the observation of pulse broadening and Group Velocity Dispersion in calcite using the femtosecond laser. Currently, he is working on the observation of SRS and SC for O-wave and E-wave using the femtosecond laser, the modification of Random Walk Antenna, and the construction of CW SRS microscope. Besides his research, he is also teaching at CityTech and LaGuardia CC as an. adjunct lecturer. He originated from Bangladesh and he loves cricket.

Dr. Lingyan Shi

Assistant Professor
University of California

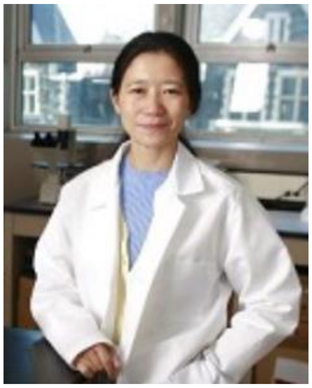
Dr. Lingyan Shi

Dr. Shi is an Assistant Professor in Department of Bioengineering, University of California San Diego (UCSD). She received her Ph.D. in Biomedical Engineering from the City College of New York (CCNY). Prior to joining UCSD, she had her postdoctoral trainings first with Dr. Alfano in the Institute for Ultrafast Spectroscopy and Lasers (IUSL) at CCNY, and then with Dr. Min at Columbia University. Dr. Shi's research focuses on developing and applying new optical imaging and spectroscopic technologies to investigate cellular metabolism, neurodegenerative diseases, cancer, drug delivery, and development in living organisms. Dr. Shi's major scientific contributions include the discovery of the "Golden Optical Window" for deep brain imaging, and the development of a breakthrough platform that combines deuterium probing with stimulated Raman scattering microscopy for optical imaging of metabolic dynamics in animals in situ. She continues to combine bioorthogonal labeling with stimulated Raman scattering (SRS) and multiphoton microscopy (MPM) for directly visualizing complex molecular events at sub-cellular scale in situ. These technologies emerged as potentially powerful tools for disease detection, diagnosis and treatment, as well as for mechanistic understanding of scientific fundamentals. Dr. Shi won the 2018 Blavatnik Regional Awards for Young Scientists

IUSL Faculty

Bingmei Fu

Professor, Biomedical Engineering,
City College of New York



Dr. Bingmei M. Fu received her B.S., M.S. from the Department of Modern Mechanics of the University of Science and Technology of China in 1985 and 1988, respectively. Then she worked as an assistant professor for one year in Southwest Jiaotong University before she came to the U.S. in 1989. She obtained a Ph.D. in Mechanical Engineering from the City University of New York in 1995. After working for three years as a NIH postdoctoral fellow in the School of Medicine, University of California, Davis, she joined the Department of Mechanical Engineering at the University of Nevada, Las Vegas in 1998 and moved to the Department of Biomedical Engineering of the City College of the City University of New York in the fall of 2004.

Dr. Fu's major research activities involve modeling nano and micro transport phenomena in smicrocirculation, such as in transvascular, transcellular and transinterstitial processes, and in vivo animal study on mechanisms of microvessel permeability related diseases. Her current research is focused on how to control microvessel permeability and cell adhesion molecules in vascular endothelium to prohibit tumor metastasis, how flow conditions affect thrombus formation and how to deliver drugs to the brain through the blood-brain barrier and the cerebral spinal fluid ventricles. These research projects have been supported by NIH, NSF, NASA and Andrew Grove Foundation, which includes a NSF CAREER award

Invited Presentations

(1 invited keynote, 1 invited symposium and 1 invited session speaker)

"Organization and Ultra-Structural Components of Endothelial Surface Glycocalyx Revealed by Stochastic Optical Reconstruction Microscopy (STORM)" The 7th Sino-American Workshop on Biomedical Engineering and China-Oversea Joint Workshop on Biomechanics, July 20-24, 2019, Chongqing, China (**Invited Keynote**).

"Using Master's programs and post-undergraduate experiences to increase the diversity of the PhD pipeline" 4th BME Education Summit Meeting, Cleveland, May 29-31, 2019 **(Invited session speaker).**

"The Blood-brain barrier and its modulation by tDCS", Experimental Biology 2019, Orlando, FL, April 6-9, 2019. **(Invited symposium speaker).**

Publications

(4 journal articles, 2 conference proceedings and 3 abstracts)

Peer-reviewed Journal articles

1. Xiao LL, Lin CS, Chen S, Liu Y, Fu BM, Yan WW. Effects of red blood cell aggregation on the blood flow in a symmetrical stenosed microvessel. Biomech Model Mechanobiol. 2019 Jul 11. doi: 10.1007/s10237-019-01202-9.
2. Zeng Y, Yao X, Liu X, He X, Li L, Liu X, Yan Z, Wu J, Fu BM. Anti-angiogenesis triggers exosomes release from endothelial cells to promote tumor vasculogenesis. J Extracell Vesicles. 2019 Jun 17;8(1):1629865. doi: 10.1080/20013078.2019.1629865.
3. Cui J, Liu Y, Fu BM. Numerical study on the dynamics of primary cilium in pulsatile flows by the immersed boundary-lattice Boltzmann method. Biomech Model Mechanobiol. 2019 Jun 29. doi: 10.1007/s10237-019-01192-8.
4. Fan J, Sun Y, Xia Y, Tarbell JM, Fu BM. Endothelial surface glycocalyx (ESG) components and ultra-structure revealed by stochastic optical reconstruction microscopy (STORM). Biorheology. 2019 Apr 26. doi: 10.3233/BIR-180204

Peer-reviewed conference proceedings

1. Jie Fan, Yi Sun, Yifan Xia, John Tarbell and Bingmei M. Fu "Organization and Ultra-Structural Components of Endothelial Surface Glycocalyx Revealed by Stochastic Optical Reconstruction Microscopy (STORM)" Proc. of the 7th Sino-American Workshop on Biomedical Engineering and China-Oversea Joint Workshop on Biomechanics, July 20-24, 2019, Chongqing, China. J. of Medical Biomechanics.
2. Huan Yin, Lizhen Wang, Bingmei M. Fu and Yubo Fan "Mechano-sensing and wall shear stress redistribution by endothelial primary cilium "Proc. of the 7th Sino-American Workshop on Biomedical Engineering and China-Oversea Joint Workshop on Biomechanics, July 20-24, 2019, Chongqing, China.

Peer-reviewed abstracts

1. Yifan Xia, Wasem Khalid, Marom Bikson and Bingmei M. Fu "Transcranial Direct Current Stimulation Can Increase Solute Transport in Brain Tissue" BMES 2019, Philadelphia, Oct. 16-19, 2019.
2. Yifan Xia, Eric Luu, Guangyao Huang, Yan Sun, Bin Xu, Kam W. Leong and Bingmei M. Fu "Characterization of the Blood-Brain Barrier Deficits in Brain Microvascular Endothelial Cells Differentiated from Induced Pluripotent Stem Cells from the Patients with 22q11.2 Microdeletion Syndrome." BMES 2019, Philadelphia, PA. Oct. 16-19, 2019.
3. Ye Zeng and Bingmei. M. Fu "Anti-angiogenesis triggers exosomes release from endothelial cells to promote tumor vasculogenesis", FASEB J, EB2019, April 6-9, Orlando, FL, 2019.

Awards and Honors

Dean's Award for Excellence in Research, Teaching and Service
Elected Secretary of the World Association of Chinese Biomedical Engineers
Editorial board: Medicine in Novel Technology and Devices, Elsevier
Conference Co-Chair of 7th Sino-American Workshop on Biomed Engineering & China-Oversea Joint Workshop on Biomechanics, July 20th ~July 24th, 2019, Chongqing, China.

Students supervised (2 Ph.D., 2 Master and 8 under)
External funding (total costs from 2 NIH grants for Fu: **$229,710**)

Teresa J. Bandosz

Environmental Chemistry/Materials Science

City College of New York

Teresa J. Bandosz holds Ph.D. in Chemical Engineering and D.Sc. in Physical Chemistry. Prof. She has been a faculty member of the Chemistry Department of CCNY/CUNY since 1996 (full professor since 2005) and the member of CUNY Energy Institute. Dr. Bandosz has a broad experience in the field of materials preparation, and their applications to environmental problems related to development of adsorbents for gas separation. For three years she was associated with Dalian University of Technology in China as a sky scholar/ guest professor of Chemical Engineering. Dr. Bandosz is a Fulbright Senior Scholar (2016/2017). She edited the book "Activated carbon surface in environmental remediation," published by Elsevier (2006). Her work during last 30 years has resulted in 6 US patents and over 400 publications in peer-reviewed journals. Her recent research interests include synthesis of Graphene/ MOF, Graphene/hydroxide composites for separation and energy harvesting applications, visible light photoactivity of carbonaceous materials, energy storage, and CO2 sequestration and reduction, development of carbon based sensors and ORR catalysts. Since 2014 she is coeditor of Journal of Colloid and Interface Science. She was on the Advisory Board of American Carbon Society (2011-2016). Dr. Bandosz serves on the Board of Directors of International Adsorption Society and on the Editorial Boards of Carbon, C, Adsorption Science and Technology, and Applied Surface Science. She was selected as The Graffin Lecturer for 2016/2017 by American Carbon Society.

Achievements:

1. H Index 69 (SciFinder, August 2019); total citations> 18,100
2. American Carbon Society Fellow
3. Plenary lecturer at Carbon 2019 Conference (July16, 2019)
4. Plenary Speaker at Carbon for Energy and Environmental Applications, Alicante, Spain, Oct. 2019.
5. Appointed to the Expert Panel of the Research Foundation Flanders (2019-2021)

Publications:

1. Defectous UiO-66 MOF Nanocomposites as Reactive Media of Superior Protection against Toxic Vapors D.A. Giannakoudakis, T.J. Bandosz ACS Appl. Mater. Interfaces 2020. http://dx.doi.org/10.1021/acsami.9b17314.
2. Exploring the options for the improvement of H2S adsorption on sludge derived adsorbents: Building the composite with porous carbons M. Florent, A. Policicchio, S. Niewidomski, T.J. Bandosz J. Cleaner Product. 2020. http://doi.org/10.1016/j.jclepro.2019.119412
3. Ultramicropore-influenced mechanism of oxygen electroreduction on metal-free carbon catalysts D. Barrera, M. Florent, M. Kulko, T.J. Bandosz J. Mater. Chem A. 2019, 7, 27110-27123, http://doi.org/10.1039/C9TA10850E
4. Solar light-driven photocatalytic degradation of phenol on S-doped nanoporous carbons: The role of functional groups in governing activity and selectivity T.J. Bandosz, A. Policicchio, M. Florent, W.Li, P.S. Poon, J. Matos Carbon 2020, 156, 10-23. https://doi.org/10.1016/j.carbon.2019.09.037
5. Insight into the Mechanism of Oxygen Reduction Reaction on Micro/Mesoporous Carbons: Ultramicropores versus Nitrogen-Containing Catalytic Centers in Ordered Pore Structure D. Barrera, M. Florent, K. Sapag, T.J. Bandosz ACS Appl. Energy Mater. 2019, 2, 10, 7412-7424. https://doi.org/10.1021/acsaem.9b01427
6. TiO2/S-Doped Carbons Hybrids: Analysis of Their Interfacial and Surface Features T.J.Bandosz, A. Policicchio, M. Florent, P.S.Poon, J. Matos Molecules 2019, 24(19), 3585; https://doi.org/10.3390/molecules24193585
7. Evaluation of nitrogen- and sulfur-doped porous carbon textiles as electrode materials for flexible supercapacitors. M. Barczak, T.J. Bandosz. Electrochimica Acta 2019, 305, 125-136. https://doi.org/10.1016/j.electacta.2019.03.014
8. Magnetic soot: surface properties and application to remove oil contamination from water Nazhipkyzy, M.; Nurgain,A.; Florent, M.; Policicchio, A.; Bandosz. T.J. J. Environ. Chem. Eng. 3 (2019) 103074
9. Combination of alkalinity and porosity enhances formaldehyde adsorption on pig manure -derived composite adsorbents. Suresh, S.; Kante, K.; Fini, E. ; Bandosz, T.J. Micro. Meso. Mat. 286, (2019) 155-162.
10. Degradation of endocrine disruptor, bisphenol-A, on a mixed oxidation state manganese oxide/modified graphite oxide composite: A role of carbonaceous phase. Saroyan, S.; Bele, S.; Ginnakoudakis, D. A.;Samanidou, V.F.; Bandosz, T.J. Deliyanni, E.A. J. Coll. Interf. Sci. 539 (2019) 5160524.
11. Exploring resistance changes of porous carbon upon physical adsorption of VOCs. Kante, K.; Florent, M.; Temirgaliyeva, A.; Lesbayev, B.; Bandosz, T.J. Carbon 146 (2019) 56580571.
12. Nitrogen-containing activated carbon of improved electrochemical performance derived from cotton stalks using indirect chemical activation. Xu, S.S.; Qiu, S.W.; Yuan, Z.Y.; Ren, T.Z. Bandosz, T.J. J. Coll. Interf. Sc. 540 (2019) 285-294.
13. Effect of 1-(3-phenoxypropyl) pyridazin-1-ium bromide on steel corrosion inhibition in acidic medium. El-Haijaji, F.; Messali, M.; Martinez De Yuso, M.V.; Rodriguez-Castellon, E.; Almutairi, S.; Bandosz, T.J.; Algarra, M. J. Coll. Interf. Sc. 541 (2019) 418-424.
14. Fingerprint imaging using N-doped carbon dots. Milenkovic, I.; Algarra, M.; Alcoholado, C.; Cifuentes, M.; Lazaro-Martonez. J.M.; Rodriguez-Castellon, E.; Mutavdžić, D.; Radotić, K.; Bandosz, T.J. Carbon 144 (2019) 791-797.

15. Analysis of interactions of mustard gas surrogate vapors with porous carbon textiles. Giannakoudakis, D.A.; Barczak, M.; Florent, M.; Bandosz, T.J. Chem. Eng. J. 362 (2019) 758-766.
16. Polyoxometalate hybrid catalyst for detection and photodecomposition of mustard gas surrogate vapors. Giannakoudakis, D.A.; Colon-Ortiz, J.; Landers, J.; Murali, S,; Florent, M.; Neimark, A.V.; Bandosz, T..J. Appl.Surf. Sci. 4670468 (2019) 428-438.
17. Oxygen electroreduction on nanoporous carbons: textural features vs nitrogen and boron catalytic centers. Florent, M.; Wallace, R.; Bandosz, T.J. ChemCatChem 11 (2019) 851-860

Presentations:

1. On the importance of carbon nanopores on oxygen reduction reaction Teresa J. Bandosz, Deicy Barrera, Marc Florent. Okinawa Colloid 2019, Okinawa, Japan Nov. 3-7, 2019
2. Metal-free porous carbon catalyst for ORR: dressing the complexity of activity governing factors. Teresa J. Bandosz Plenary Lecture at CESEP 2019, Alicante, Spain, Oct.20-24, 2019
3. What really matters for ORR? A case study of nanoporous carbons catalytic activity Teresa J. Bandosz Beyond Adsorption-II, New York City, July 20, 2019
4. Exploring the silent aspect of carbon porosity Teresa J. Bandosz Plenary Lecture at Carbon 2019, Lexington KY, July 14-19, 2019
5. Analysis of factors affecting low concentration formaldehyde removal on porous carbon materials Giacomo de Falco and Teresa J. Bandosz 17th International Conference on the Chemistry and the Environment, June 16-20, 2019, Thessaloniki, Greece.
6. Analysis of factors affecting low concentration formaldehyde removal on porous carbon materials Giacomo de Falco and Teresa J. Bandosz Fundamentals of Adsorption 13th, May 26-31, 2019, Cairns, Australia
7. On the role of carbon pores in O2 and CO2 electroreduction. Teresa J. Bandosz Japan Adsorption 2019, May 21-23, 2019, Chiba, Japan

Postdocs Student: Alfoso Policicchio, Marc Florent, Giacomo deFalco

Visiting Ph.D. Students Chao Yang (China)

Funding:

Total grants amount received in 2019 is $464, 942

Adrian Rodriguez-Contreras

Associate Professor, Biology Department

City College of New York

Adrián Rodríguez-Contreras is an associate professor in the Biology Department at the City College of New York. He received his Ph.D. in Neuroscience, University of Cincinnati, 2001 B.Sc. in Biology, Universidad Nacional Autónoma de México, 1997. In 2008, he established the developmental neurobiology laboratory, where his main research interest is to understand how and why do early life experience and genetic programs interact during development of hearing. Other research interests include experimental approaches to investigate light-matter interactions in biological systems, application of novel imaging tools in biological research, and more recently, comparative studies of how environmental factors influence life cycles and development in the cnidarian Hydra. Dr. Rodriguez-Contreras is interested in understanding how the structure and function of the brain change during development. He uses a combination of anatomical, electrophysiological and optical techniques to study the development of auditory brainstem circuits involved in sound localization.

Funding:

Total grants amount received in 2019 is $115,000

NIH SC1DC015907 Rodríguez-Contreras 07/06/2010-05/31/2020

Neuronal ensembles during development of tonotopic maps in the auditory system.

The goal of this study is to measure the pattern of activity in a tonotopic map during development of hearing.

Recent publications:

1. Di Guilmi MN, Noero LE, Castagna VC, Rodríguez-Contreras A, Wedemeyer C, Gomez-Casati ME, Elgoyhen AB (2019) Strenghtening of the efferent olivocochlear system leads to synaptic dysfunction and tonotopy disruption of a central auditory nucleus. Journal of Neuroscience 39(36):7037-7048.
2. Rodríguez-Contreras A. Understanding the relationship between vascular and neural cell development in the rodent auditory brainstem. In: Physiology and pathology of neuroglia. Reyes-Haro D, Ed. Universidad Nacional Autónoma de México, México. In press.

Vinod Menon

Professor & Chair, Physics Department

City College of New York

Vinod Menon is a Professor of Physics and currently the Chair of the Physics Department at the City College of New York and doctoral faculty at the Graduate Center of the City University of New York (CUNY). He is a fellow of the Optical Society of America and an IEEE Distinguished Lecturer in Photonics (2018-2020). He joined CUNY in fall 2004 as part of the initiative in photonics. Prior to joining CUNY he was at Princeton University (2001-2004) where he was the Lucent Bell Labs Post-Doctoral Fellow in Photonics. He received his MSc in Physics (Quantum Optics specialization) from the University of Hyderabad, India in 1995 and his Ph.D. in Physics from the University of Massachusetts in 2001. He has held visiting positions at MIT, Max Planck Institute for the Science of Light, and Princeton University. He also serves on the editorial board of Optica, an OSA journal. His current research interests include quantum simulation using condensates in solid state systems, cavity QED with two-dimensional semiconductors, controlling transport and energetics in organic molecules through strong light-matter coupling, and engineered nonlinear optical materials. More details about his group can be found at www.lanmp.org.

Funding:

Total grant amount received in 2019 is $2,284,000

Current Grants:

1. Quantum emulators based on polaritonic lattices (NSF - QII-TAQS) – PI
2. Integrated quantum photonics using van der Waals materials (NSF ECCS) – PI
3. Excitonics and Polaritonics using 2D materials (NSF – EFRI 2DARE) – PI
4. Interface states and excitons at heterojunctions between 2D and 3D materials system (NSF – DMR) – PI
5. Ultrafast light emitters based on photonic hypercrystals and 2D Semiconductors (ARO) – PI
6. Control of energy transfer and molecular excitations via strongly coupled light-matter quasiparticles (DOE – BES) – PI

7. Quantum circuits through symmetry driven valley optoelectronics (NSF QII-TAQS) – Co-PI.
8. Harnessing the ultimate limits of light-matter interaction with polaritonic metamaterials (DARPA) – Co-PI
9. Electrical control of exciton-polaritons in 2D materials, ARO (MURI – Supplement) – PI
10. Development of a scanning-probe-assisted confocal microscope for the investigation of optical and magnetic phenomena (NSF – MRI) – Co-PI
11. Center for Interface Design and Engineered Assembly of Low-Dimensional Systems (IDEALS) (NSF – CREST) – Faculty participant
12. Center for precision assembly of superstratic and superatomic solids (NSF-MRSEC – Columbia University & CCNY)- Faculty participant

Accomplishments:

1. OSA Fellow (Class of 2020)
2. IEEE Photonics Society Distinguished Lectureship (2018-19 and 2019-20)
3. Media coverage: "Half-light half-matter quasiparticle-based LED," Phys.org, Photonics.com, Scitech daily, etc. October 2019

Publications

1. "Modifying the spectral weights of vibronic transitions via strong coupling to surface plasmons," R. Deshmukh, P. Marquez, A. Panda, M. Y. Sfeir, S. R. Forrest and V. M. Menon, ACS Photonics (2019) https://doi.org/10.1021/acsphotonics.9b01357.
2. "Chiral emission of electric dipoles coupled to optical hyperbolic materials," W. Liu, V. M. Menon, S. Gao, and G. S. Agarwal, Phys. Rev. B 100, 245428 (2019)
3. "A room temperature polariton LED based on monolayer WS2," J. Gu, B. Chakraborty, M. Khatoniyar, and V. M. Menon, Nature Nanotech. 14, 1024 (2019)
4. "Hybrid Tamm Exciton Polaritons in organic microcavity," B. Liu, R. Wu, and V. M. Menon, J. Phys. Chem. C.123, 265509, (2019)
5. "Coupling of deterministically activated quantum emitters in hexagonal boron nitride to plasmonic surface lattice resonances," N. Proscia, R. Collison, C.A. Meriles, and V. M. Menon, Nanophototonics 8, 2057 (2019)
6. "Direct observation of gate tunable dark trions in monolayer WSe2" Zhipeng Li, Tianmeng Wang, Zhengguang Lu, Mandeep Khatoniar, Zhen Lian, Yuze Meng, Mark Blei, Takashi Taniguchi, Kenji Watanabe, Stephene McGill, Sefaattin Tongay, Vinod M. Menon, Dmitry Smirnov, Su-Fei Shi, Nano Lett. 19, 6886 (2019)
7. "Guiding of visible photons at the angstrom thickness limit," X. Zhang, C De-Eknamkul, J. Gu, A. Boehmke, V. M. Menon, J. Khurgin and E. Cubukcu, Nature Nanotech. 14, 844 (2019)
8. "Polariton chemistry: Thinking inside the (photon) box," J. Yuen-Zhou, and V. M. Menon PNAS 116, 5214 (2019)
9. "Valley selective optical control of excitons in 2D materials using chiral metasurface," S. Guddala, R. Bushati, M. Li, A. Khanikaev, and V. M. Menon, Opt. Mat. Express 9, 536 (2019).

Total Funding:

The grants total for IUSL in 2019 is about $ 3.531 M

Assembled and Edited by: Ms. Sonali Shintre

The Institute for Ultrafast Spectroscopy and Lasers was founded in 1982 at City College of New York by Professor Robert R. Alfano.