GOMBOJAV O. ARIUNBOLD

CONTACT INFORMATION

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RESEARCH INTERESTS

As an atomic molecular optical (AMO) physicist, my research primarily focuses on experimental and theoretical studies of collective behaviors of quantum particles using rhythmic pulsed excitations for measuring temporal and imaging spatial coherence of collective emissions. These results help better understand how to create and maintain a macroscopic quantum coherence in quantum materials under practical conditions. Additionally, my research involves development and applications of label-free chemical imaging-spectroscopy that contributes to addressing biomedical, agricultural and environmental problems. A final thrust area of my research is development of a cost-effective, portable optical sensing technologies for plant and polymer material studies.

EDUCATION

Ph.D., Physics — *2016-2011* — Texas A&M University

Dissertation: Ultrafast Cooperative Phenomena in Coherently Prepared Media: From Superfluorescence to Coherent Raman Scattering and Applications
Advisor: Prof. M. O. Scully

Ph.D., Optics and Optoelectronics — *1997-2000* — Palacky University, Olomouc, Czechia

Dissertation: Interaction of Matter with Nonclassical Light
Advisor: Prof. J. Perina

M.S., Physics — *1995-1996* — National University of Mongolia

Advisors: Prof. Ts. Gantsog and Prof. D. Dambasuren

B.S., Physics — *1990-1994* — National University of Mongolia

Advisor: Prof. D. Dambasuren

WORK EXPERIENCE

Mississippi State University (MSU) *2015-* Assistant Professor

As an assistant professor at MSU, I have established ultrafast laser research lab at MSU, equipped with the cutting-edge femtosecond laser with a non-collinear optical parametric amplifier and a temperature-controlled cryostat vacuum system. So far, eight peer-reviewed publications and eight peer-reviewed conference proceedings have been produced based on the experimental data taken exclusively by these systems. My four graduate students and one postdoc have co-authored 13 out of total 25 peer-review publications produced by me since 2015. In the period from 2015 through mid-August 2022, my papers have been cited more than 640 times; the papers published since 2015 have been cited 176 times.

My research is based on three focus area: (i) atomic molecular optical (AMO) physics; (ii) ultrafast laser spectroscopy and applications; and (iii) optical sensors.

(i) AMO physics: My first research goal is to address the primary question whether the *atomic* macroscopic quantum coherence (MQC) is initiated by means of a quantum synchronization (i.e., a quantum analog of classical synchronization) or not. I am developing a new model as a correspondence of collective phenomenon to synchronization. These results enable to better understand how to create and maintain MQC of polarons in quantum materials under practical conditions. Within this focus area, two experimental papers have been published, and one invited review and one theoretical paper are under review. My preproposal submitted to ONR Global titled "Understanding the essentials of superfluorescence in perovskites and disordered materials" has been encouraged. My NSF CAREER proposal that is currently under review covers this topic of creating and maintaining MQC in atomic gas.

Next question is whether the *molecular* MQC is initiated by means of a quantum synchronization or not. My research focuses on studying molecular MQC associated with coherent anti-Stokes Raman scattering (CARS) processes. To study molecules, I performed (i) a theoretical prediction (2016, 2017) and experimental demonstration (2020) of an existence of deferred MQC buildup of the ensemble of molecules, for the first time; and (ii) an observation of collective emissions from pyridine-water complex (2021). To reveal molecular MQC, I have developed new analytical tool of one- and two-dimensional correlation analyses (2021).

My research also addresses the question of the existence of quantum analog of vibration isolation mechanism in atomic, molecular and polaronic systems. Currently, my research group focuses on repeating the above-mentioned high temperature superradiance experiments with methyl-ammonium lead iodide. At MSU, Dr. Gangishetty is collaborating with my group to develop several compositions and geometries of perovskites. For this purpose, I have recently installed cryostat vacuum system capable of operating at liquid nitrogen and helium temperatures. In addition, as an expert in coherent Raman spectroscopy, I will study phonon dynamics as to reveal polaronic characteristics. Polaronic characteristics will help to understand above mentioned mechanism.

The long-term goal of my research in this focus area is to establish a universal quantum synchronization mechanism for macroscopic quantum phase transition phenomena in quantum gases, liquids, and solid-state materials under dephasing.

(ii) Ultrafast laser spectroscopy and applications: My group also specializes at applying ultrafast nonlinear optical microscopy and spectroscopy where the femtosecond laser interacts with molecules. Special cases of these techniques are based on CARS, CSRS, sum frequency generation (SFG), second harmonic generation (SHG), two- and three-photon absorption nonlinear optical processes. The group focuses on promoting the implementation of ultrafast nonlinear optical microscopy and spectroscopy in agriculture, healthcare and environmental ecology. I initiated and co-chaired the OPTICA incubator meeting *"Agri-Photonics Incubator: Advanced Spectroscopy* in Precision Agriculture" in May 2019 in Washington, DC and published featured article on this topic in Optics and Photonics News (2019).

I have developed a new CARS spectroscopy technique involving only Gaussian pulses. For this process, I found analytic solutions using the Faddeeva function (an error function with complex argument). I have published an invited review in addition to multiple papers on CARS. This all-Gaussian CARS (MSU-CARS) is used to demonstrate my prediction of deferred molecular MQC buildup in CARS process. This buildup is further used to distinguish coherently versus incoherently excited multiple species e.g., benzene versus water. My students B. Semon and S. Nagpal co-authored multiple papers on this topic.

I have developed an advanced nonlinear optical imaging platform by upgrading the MSU-CARS setup. This MSU-CARS setup has been modified to a nonlinear optical imaging (NOI) technique. The NOI platform records CARS, SFG, SHG and optical images nearly simultaneously (2021) and is designed for fixed tissue characterizations. I introduced a new analytical tool based on spatial q-score statistical image analysis for fixed tissues. The q-score serves as a spatial heterogeneity measure of collagen. This research is extended to collagen-rich tissues including bone, tendon, skin and many more stained and unstained fixed tissues. The NOI platform's sensitivity reaches down to about 600 parts per million (ppm) by capturing images for the nitrogen molecular vibrations against the images of the background noise in the ambient air (in the lab). My student B. Semon is working on this project and co-authored in multiple papers.

To better understand the measured data, for the first time, I applied the traditional two-dimensional correlation spectroscopy (2DCOS) to coherent Raman spectroscopy. I introduced a new noise correlation coherent Raman spectroscopy aided by this analytical tool. I introduced the intensity-intensity correlation in spectral domain and proved that it is identical to the diagonal projection of the traditional 2DCOS map. Thus, this measure should be understood as 1DCOS. My student S. Nagpal has completed her PhD thesis on this topic. My team published multiple papers about this phenomenon, mostly in Applied Spectroscopy (impact factor of 3.6).

(iii) Optical sensors: The final focus area of my research is development of optical sensors. I am developing cost-effective optical sensors with implementations in agriculture, healthcare and environmental ecology. Two of my master's students completed theses on the development of laser-induced fluorescence remote sensing with drone. I am co-PI (10% for MSU) for the research project on environmental pollutions funded by US Coastal Research Program (USCSRP) and U.S. Army Corps of Engineers (USACE).

My research group has integrated the digital holography techniques with Raman spectroscopy to image microparticles without microscopic objective lens. The key achievement is that this technique can characterize microparticles both chemically and morphologically in standoff configuration (2017,2018).

A low-cost portable sensor module based on laser-induced fluorescence was constructed by my team (2018). The laser induced fluorescence spectra from plant leaves have been obtained and analyzed. The micro-sized spectrometer used in the module has spectral response in the visible region and the excitation source is at UV region which allows quick and easy sensing up to 30 m away from the target. Thus, this module system is a good candidate for future remote sensing applications.

With the increased equipment capacity, I have been able to co-establish and been supervising the second lab for optical materials at MSU. Two homemade Raman microscopes (portable and advanced) and laser-induced breakdown spectroscopy setup using three high-power nanosecond lasers are available in this lab for studying plants and microplastics.

Texas A&M University (TAMU) *2013-2015* Research Professor at Texas A&M Engineering Experiment Station (TEES)

Supervised and performed the experiments on atomic macroscopic quantum coherence, coherent Raman spectroscopy, Raman spectroscopy and remote sensing for plant research in three different labs at TAMU. Mentored graduate students: C. Ballman, Z. Yi, L. Yuan, A. Traverso, T. Begzjav, J. Thompson, and N. Altangerel. Developed and submitted multiple research proposals as a Co-PI. Co-organized meetings, symposiums, and summer schools. Presented talks and posters at international and national conferences and workshops.

Baylor University (BU) *2014-2015* Visiting Scientist

Moved the lab equipment located at Princeton University to Baylor Research and Innovation Collaborative and established a new femtosecond laser lab as a part of BRIC labs at BU. Performed experiments and provided technical assistance in the BU lab.

National University of Mongolia (NUM) *2000-2002, 2013* Associate Professor

Taught electromagnetic theory, analytical mechanics, quantum chemistry, and quantum mechanics. Introduced new courses such as ultrafast and nonlinear optics, the fundamentals of photonics and quantum optics. Advised the newly established OPTICA student chapter at NUM. Mentored undergraduate and graduate students. Established a new computer lab for physics students at NUM. Created a graduate student lounge at NUM for the first time. Presented talks at public schools and universities.

University of Arizona (U of A) *2011-2012* Research Associate (Experimental Physics)

Participated in the Multidisciplinary University Research Initiative (MURI) program in the prof. J. Moloney's research group at the College of Optical Sciences. Performed experiments using the high energy femtosecond and nanosecond pulsed lasers and studied extreme nonlinear optics in air. Presented talks and published multiple peer-reviewed papers.
Advisor: Prof. J. Moloney.

TAMU *2006-2011* Research Assistant (Experimental Physics)

Conducted experimental research using femtosecond lasers in atoms and molecules in the Institute of Quantum Sciences and Engineering. Participated in multiple projects including bacterial spore detection. Organized symposiums, presented talks, and published papers.
Advisor: Prof. M. O. Scully.

TAMU *2003, 2005-2006* Research Associate (Theoretical Quantum Optics)

Conducted theoretical research on various quantum optics problems in the Institute of Quantum Sciences and Engineering. Organized symposiums, presented talks, and published multiple peer-reviewed papers.
Advisor: Prof. M. O. Scully.

Max-Planck Institute (MPQ) *2003-2004* Alexander von Humboldt Research Fellow

Conducted theoretical research to explain experimental data obtained by one atom maser (micromaser) in Prof. H. Walther's research group of in the Max-Planck Institute for Quantum Optics in Germany. Presented talks at multiple universities and institutes across Germany and Austria. Published peer-reviewed papers.
Advisor: Prof. H. Walther.

Palacky University (PU) *1997-2000* Research Assistant (Theoretical Quantum Optics)

Conducted theoretical research in Prof. J. Perina's research group in the Department of Optics at Palacky University. Presented talks at annual Central European conferences (1998-2000) and published peer-reviewed papers on nonlinear couplers and atom-matter interactions.
Advisor: Prof. J. Perina.

NUM *1996* Instructor

Taught electromagnetic theory courses to undergraduate students.

HONORS AND AWARDS

OPTICA *2021-* Senior Member, OPTICA (formerly OSA, The Optical Society of America)

MSU 2020 Featured in a MSU writeup on the "Newsroom" section of misstate.edu: https://www.cas.msstate.edu/news/2020/04/msu-mississippi-school-mathematics-and-science-collaboration-yields-student

MSU *2017* Featured in a MSU writeup on the "Newsroom" section of misstate.edu:

https://www.msstate.edu/newsroom/article/2017/05/msu-physics-professors-research-informs-global-food-security4

TAMU	*2010, 2011*	H. F. Heep and M. B. Heep Fellowship for Outstanding Doctoral Students
AvH Foundation	*2003, 2004*	Alexander von Humboldt Fellowship for Postdoctoral Researchers
MAS	*2002*	Outstanding Young Researcher Award, Mongolian Academy of Sciences
DAAD	*2001*	German Academic Exchange Service Scholarship
NUM	*2000*	Teaching Excellence Award, National University of Mongolia
Czech Republic	*1997-2000*	Czech Government scholarship to pursue doctoral program at Palacky University

PROFESSIONAL SOCIETIES

2006	OPTICA (formerly Optical Society of America)
2006 - 2016	American Physical Society
2019 - 2021	Society of Applied Spectroscopy

GRANTS AWARDED

USCRP & USACE — *2022-2025* — Microplastic presence and circulation in Galveston, Corpus Christi, and Matagorda Bays.

Principal Investigator. Jeremy. Conkle (Texas A&M University-Corpus Christi), Co-PI. Darek. Bogucki (Texas A&M University-Corpus Christi). Co-PI: **Gombojav Ariunbold** (MSU). Total Award Amount: $320,479 over 3 years, MSU Award Amount: $29,682. Award Start Date: July 18, 2022

SRI — *2021* — SRI Track I: A prototype of a novel spatio-chemical imaging microscope

Principal Investigator: **Gombojav Ariunbold** (MSU). Co-PI: Haifeng Wang (MSU). College of Arts & Sciences Strategic Research Initiative: Faculty Seed Funding program. Total Award Amount: $7,000 over 1 year. Award Start Date: January 1, 2021.

ORED — *2020* — A System Comparison of Machine Learning-Based 3D Micro-Flow Volume Construction

Principal Investigator: Dr. Haifeng Wang (MSU), Co-PI: **Gombojav Ariunbold** (MSU). Office of Research and Economic Development, Undergraduate Research Program. Total Award Amount: $ 2,000. Award Start Date: January 1, 2020.

OPTICA — *2019* — Agri-Photonics Incubator: Advanced Spectroscopy in Precision Agriculture

Co-Chair: Gombojav O. Ariunbold. OPTICA, Conference proposal to organize the OSA Incubator meeting, May 12-14, 2019, OSA Headquarters, Washington, DC.

OTHER GRANT PROPOSALS

NSF Career — *Pending* — Macroscopic Quantum Atomic Coherence from Non-Local Dephasing

Principal Investigator: **Gombojav Ariunbold** (MSU). Funding Agency: National Science Foundation Faculty Early Career Development Program. Amount requested: $532,297 (2023-2028).

ONR Global — *Encouraged* — Understanding the essentials of superfluorescence in perovskites and disordered materials.

Principal Investigator: Jav Davaasambuu (NUM). Co-PIs: **Gombojav O Ariunbold** (MSU), Mahesh Gangishetty (MSU), J. Temuujin (NUM), Kh. Odkhuu (Incheon National University). Funding Agency: Office of Naval Resdearch Global. $400,265.

NSF-SBIR *Encouraged* Pitch submission

Principal Investigator: Dongmao Zhang (MSU). Co-PI: **Gombojav O. Ariunbold** (MSU). Funding Agency: America's Seed Fund, powered by National Science Foundation. Amount requested: $256,000

MENTORSHIP

Postdoc *2017-2018* Nava Subedi

Mentored Postdoctoral Scholar Dr. Nava Subedi on his project involving studying morphological and chemical properties of microparticles by integrating Raman spectroscopy with digital holographic microscopy. I introduced the use of Raman spectroscopy in exploring plant phenotyping and early abiotic plant stress response to Dr. Subedi and trained him to build a confocal Raman setup, operate spectrometer and imaging camera, and process data using MATLAB. To help Dr. Subedi gain experience and develop his academic career, I provided him with opportunities to attend conferences and visit funding agencies. Working in my lab, Dr. Subedi co-authored one peer-reviewed research article and two conference proceedings papers and accepted the position of the postdoctoral research associate at Washington State University. Currently Dr. Subedi is an engineer at Intel Corporation.

Grad Student *2016-2021* Supriya Nagpal – graduated with Ph.D in Physics

Mentored Ms. Supriya Nagpal on her master's thesis involving the use of Raman and fluorescent spectroscopy to study the chemical profile of water and plants. I trained Ms. Nagpal starting from the basics of spectroscopy, remote sensing and Raman spectroscopy to advanced research techniques. Under my guidance, Ms. Nagpal completed research on unmanned aerial vehicle with laser induced fluorescence sensing and presented her research at the nationally recognized conference. In PhD program, Ms. Nagpal conducted research on correlated coherent nonlinear spectroscopy based on high-order correlation analysis. I trained Ms. Nagpal in the mathematical basis of two-dimensional correlation spectroscopy and its conversion to newly defined one-dimensional diagonal projection for correlated coherent Stokes and anti-Stokes Raman spectroscopy. I also advised and guided her in the preparation of research publications that resulted in four publications in peer-reviewed journals and four conference proceedings papers. Ms. Nagpal successfully defended his PhD dissertation in 2021 and is currently employed as an engineer at Intel Corporation.

Grad Student *2018-* Bryan Semon

Currently mentoring Ph.D. candidate Bryan Semon on his dissertation work in coherent Raman wide-field chemical single-shot imaging. I trained Mr. Semon to take data, process the data using MATLAB and perform experiments both for Raman spectroscopy and coherent anti-Stokes Raman spectroscopy. Mr. Semon studied the chemical imaging of formalin-fixed paraffin (FFPE) connective tissues, and characterization of microbeads with coherent Raman spectroscopy wide-field microscopic imaging. In 2021 Mr. Semon completed a project supported by an SRI grant to design a chemical wide-imaging microscope for unmanned aerial vehicles. I advised and guided Mr. Semon in the preparation of research publications that resulted in four publications in peer-reviewed journals and four conference proceeding papers.

Undergrad *2019* Drew Moran

Mentored undergraduate biomedical engineering major Drew Moran in his research on Raman spectroscopy of optically trapped microparticles. Mr. Moran presented his research at the Spring Undergraduate Research Symposium in April 2020.

High school *2019* Collin Jeck

Mentored local high school student Collin Jeck (graduated in 2020) from the Mississippi School for Mathematics and Science (MSMS) on a project involving optical trapping and imaging of microbeads and determining diffusion dynamics in fluid environment. I taught Mr. Jeck how to optimize and image microbeads while those are optically trapped under the microscope setup. This project replicated the early experimental setup used by Dr. Arthur Ashkin, who was awarded a Nobel Prize in Physics for his invention of optical trapping in 2018. Under my mentorship Mr. Jeck successfully accomplished optical trapping of a

single polystyrene microparticle suspended in liquid. His research was highlighted at MSU website. Currently Mr. Jeck is pursuing academic program in astrophysics at the University of Colorado.

Undergrad *2020-2021* David Heson

Mentored undergraduate physics major David Heson on a project involving enhancement of microplastic images using U-Net based deep learning algorithm. Mr. Heson successfully presented his research at the Summer Undergraduate Research Symposium in August 2021.

Undergrad *2021 -* Delgermurun Bayarsaikhan

Currently mentoring undergraduate industrial and systems engineering major Delgermurun Bayarsaikhan (as a Freshman) on the project that uses drones to collect laser induced chlorophyll fluorescence data. Mr. Bayarsaiakhan is testing flight quality to meet a stable dynamic quadcopter model. Mr. Bayarsaikhan presented his research at the Summer Undergraduate Research Symposium in August 2022.

Grad Student *2020-2021* Alaa Chriat

Mentored Ph.D. student (engineering) Alaa Chriat developed the codes to control automatic chemical imaging and a home-made drone while taking laser-induced spectroscopy.

Grad Student *2015-2017* Adam Powers –graduated with M.S. in Physics

Mentored M.S. candidate Adam Powers on his dissertation work on development of a portable laser-induced fluorescence (LIF) sensor imaging in agricultural setting. Mr. Power's work involved developing and testing an autonomous unmanned aerial vehicle (UAV) platform for carrying remote spectroscopy equipment. I trained him in the basics of imaging and spectroscopy. Currently Mr. Powers is a senior research scientist at BAE Systems, Inc.

Grad Student *2016-2018* Prakash Adhikari – graduated with Ph.D. in Physics

Mentored graduate student Prakash Adhikari on his research on digital holography and organic compound in water. I trained Mr. Adhikari starting from the basics of spectroscopy, remote sensing and Raman spectroscopy to performing advanced Raman spectroscopy experiments, taking data, and using MATLAB to process the data. Currently Dr. Adhikari is an engineer at Intel Corporation.

Grad Student *2017-2018* Fatemah Alharthi

Mentored M.S. candidate Ms. Fatemah Alharthi in her research focused on in-vivo Raman spectroscopy for plant stress responses. I trained Ms. Alharthi to take Raman spectra from plants, give stress, and process data using MATLAB. Ms. Alharthi successfully defended her master's thesis in May 2018 and advanced to the PhD program.

Undergrad Student *2013-2015* Orkhongua Batjargal – graduated with Ph.D. in Physics

Mentored Ms. Orkhongua Batjargal, a physics major student at the National University of Mongolia, in her undergraduate research on theoretical understanding of coherent Raman scattering. Upon my recommendation, Ms. Batjargal was accepted to the Ph.D. program at Wyatt College of Optical Sciences, University of Arizona. In 2022 Ms. Batjargal successfully completed her doctoral program and is currently employed as a senior fiber laser engineer at Innovusion Inc.

Undergrad Student *2013-2015* Erdenebulgan Lkhagvadorj

Mentored Ms. Lkhagvadaorj, a physics major student at the National University of Mongolia, in his undergraduate research on theory of single molecule fluorescence energy transfer. Currently Ms. Lkhagvadorj is a researcher at the Mongolian Academy of Sciences in Ulaanbaatar.

Undergrad Student *2002* Tuguldur Begzjav – graduated with Ph.D. in Physics

Mentored Mr. Begzjav, a physics major student at the National University of Mongolia. Upon my recommendation, Mr. Begzjav pursued a doctoral education at Texas A&M University and successfully defended his dissertation titled "Quantum coherence phenomena: From spectroscopy to accelerating detectors". Currently Dr. Begzjav is an assistant Professor at the National University of Mongolia.

Undergrad Student *2002* Dagva Baatarkhuu

Mentored Mr. Baatarkhuu, a physics major student at the National University of Mongolia, in his undergraduate research on theory of one atom maser. Currently Mr. Baatarkhuu is a researcher at the Mongolian Academy of Sciences in Ulaanbaatar.

LEADERSHIP AND SERVICE

Front.Phys. *2022-* Review editor - Frontiers in Physics (IF 3.7)

MSU *2021-* Graduate E&M Placement Exam and Preliminary Exam Committees

As a member, I participate in the test preparation, proctoring, and grading the E&M placement and prelim exams for graduate students.

MSU *2021* Faculty Jury

Served as a jury at the 2021 Chemical Engineering Graduate Student Symposium.

MAS *July 2021* Symposium Planning Committee

Participated in the planning and organization of the first International Symposium on High Temperature Superfluorescence in Perovskite and Ordered Materials jointly by the Mongolian Academy of Sciences and the National University of Mongolia.

OPTICA *July 2021* OSA Optical Sensors and Sensing Congress Organizing Committee

Served as a member of Applied Industrial Spectroscopy Topical Meetings. I participated in the conference planning and organization, invited keynote speakers, and reviewed and scored conference talks. I initiated and co-organized the first Applied Industrial Spectroscopy Panel Session on Agri-Photonics (SpE2). I also organized the first Applied Industrial Spectroscopy Panel Session: Microplastics in the Environment: Challenges and Opportunities (SpE5).

MAS *May 2021* Webinar Planning Team

Organized a joint webinar international meeting "Collaborative Research Opportunities in Physics Sciences. Keynote speaker: Dr. Chagaan Baatar, program director, ONR Global.

OPTICA *June 2020* OSA Optical Sensors and Sensing Congress Organizing Committee

Served as a member of Applied Industrial Spectroscopy Topical Meetings. I participated in the session planning and organization and reviewed and scored conference talks.

CLEO *May 10-15, 2020* Session Planning Committee, Conference on Lasers and Electro-optics

I co-organized the Application and Technology Topical Review on "Optics and Photonics for Precision Agriculture. I participated in the session planning and reviewed 10 talks.

OPTICA *2019* OSA Incubator Program Organizing Committee Co-Chair

Organized and co-chaired the OSA event "Agri-Photonics Incubator: Advanced Spectroscopy in Precision Agriculture" in May 2019 in Washington, DC.

OPTICA *2019* Technical Group Member

Served as a member of the OSA Environmental Sensing Technical Group Executive Committee.

MSU *2017-* Department of Physics and Astronomy Colloquium Committee

A member of the committee that plans and organizes colloquia and seminars.

MSU *2018* Lab Operations Manager Hiring Committee

Member of the hiring committee that was tasked to evaluate, interview, and recommend for hire candidates for the lab operations manager position.

MSU *2019* Faculty Hiring Committee

Member of the hiring committee that was tasked to evaluate, interview, and recommend for hire candidates for the assistant professor position in atomic molecular plasma physics.

MSU *2015-2021* Chair, Graduate E&M Placement Exam and Preliminary Exam Committees

I organized the committees and directed the test preparation, proctoring, and grading the E&M placement and prelim exams for graduate physics students

MSU *2015-* Department of Physics and Astronomy Facility Resources Committee Chair

Overseeing and coordinating the resource use for multimedia equipment in the Howell Observatory, physics Demo Room and the PH Shop.

MSU 2015- Material Science Working Group

As a member of the group, I help to bring together all research activities at Mississippi State University related to materials research and facilitate the transfer of new ideas and the maximum utilization of shared resources.

MSU *2015-* Department of Physics and Astronomy Graduate Program Committee

As a member, my responsibilities include advising and recruiting graduate student, developing and maintaining recruiting materials and graduate admissions policy, advising the faculty on graduate curriculum changes, organizing placement and preliminary exams, advising faculty and students on Graduate School affairs and policy, and selecting candidates for fellowships and other MSU programs.

Referee *2006-* Referee - multiple journals (more than 30 manuscripts)

Nature Photonics (1), Journal of Molecular Structure (12), Optics Letters (1), Optics Express (2), Applied Optics (1), Laser Physics (1), PLOS One (1), Journal of Optics A (1), Physics Letters A (1), Journal of Physics A (1) and B (1), New Journal of Physics (1), Optics Communications (1), Plants (2), Applied Sciences (1), Frontiers in Pharmacology (1), Journal of Quantum, Electronics (1), Scientific Reports (1) and reviewer for a book proposal (IOP publishing).

PUBLICATIONS IN REFEREED JOURNALS

Processes *2022* Invited review: On macroscopic quantum coherence with synchronized atoms and molecules: Perspective
MDPI IF-3.3

O. Ariunbold, *(under review), Processes, MDPI*

Phys. Lett. A *2022* Cascade Superradiance Model
IF-2.7

G. O. Ariunbold, *(under review),* arXiv preprint arXiv:2207.11841 (2022)

Frontiers in Phys. *2022* Multiple Pathway Quantum Beats Spectroscopy
IF-3.7

Z. Yi, T. Begzjav, **G. O. Ariunbold**, A. M. Zheltikov, A. V. Sokolov, and M. O. Scully, Frontiers in Physics, 10, 921499 (2022)

Phys. Lett. A *2022* Observations of Ultrafast Superfluorescent Beatings in a Cesium Vapor Excited by Femtosecond Laser Pulses
IF-2.7

G. O. Ariunbold, V. A. Sautenkov, D. Pestov, H. Li, X. Wang, M. Zhi, T. Begzjav, R. K. Murawski, A. V. Sokolov, M. O. Scully and Yu. V. Rostovtsev, Phys. Lett. A, 428, 127945 (2022)

Appl. Spectrosc. *IF-3.6* — *2021* — Distinguishing Resonant from Non-Resonant Nonlinear Optical Processes Using Intensity–Intensity Correlation Analyses

S. Nagpal, B. Semon and **G. O. Ariunbold**, Appl. Spectrosc., 75, 1382, (2021). *(hereinafter, the names of students, as of publication date, are in red and underlined)*

Open Physics *IF-1.3* — *2021* — Ultrafast dephasing in hydrogen-bonded pyridine–water mixtures

G. O. Ariunbold, B. Semon, S. Nagpal, and Yuri Rostovtsev, Open Physics, 19, 234 (2021)

Spectrosc. Lett. *IF-1.3* — 2020 — Quantitative time-resolved buildup in three-color coherent anti-Stoke Raman scattering

G. O. Ariunbold, S. Nagpal, B. Semon, Spectroscopy Letters, 53, 1, (2020)

Appl. Spectrosc. *IF-3.6* — *2019* — Coherent Anti-Stokes–Stokes Raman Cross-Correlation Spectroscopy: Asymmetric Frequency Shifts in Hydrogen-Bonded Pyridine-Water Complexes

G. O. Ariunbold, B. Semon, S. Nagpal, P. Adhikari, Appl. Spectrosc. 73 1099 (2019)

Optics Photonics *IF-2.0* — *2019* — Advanced Spectroscopy in Precision Agriculture News

G. O. Ariunbold, A Byopadhyay, K Parameswaran, J Sacher, A Sengupta, Optics and Photonics News, 30, 40, (2019)

J. Opt. *IF-2.1* — *2018* — Contact-free microparticle characterization via Raman spectroscopy and digital holography

N.R. Subedi, P. Adhikari, M. Berg, and **G. O. Ariunbold**, J. Opt. 20 095608 (2018)

Optics Continuum *IF-1.9* — *2018* — Asymmetric spectral noise correlations in coherent Stokes and anti-Stokes Raman scatterings

G. O. Ariunbold, Optics Continuum, 1, 832 (2018)

PNAS *I.F-12.8* — *2017* — Reply to Dong and Zhao: Plant stress via Raman spectroscopy

N. Altangerel, **G. O. Ariunbold**, et al., Proc. Nat. Acad. Sci., 114, E5488 (2017)

PNAS *IF-12.8* — *2017* — In vivo diagnostics of early abiotic plant stress response via Raman spectroscopy

N. Altangerel, **G. O. Ariunbold**, et al., PNAS, 114, 3393 (2017). Research highlight by Chris Surridge "Remote phenotyping Raman reveals stress" Plant Nature, 3, 17052, (2017)

J. Raman Spectrosc. *I.F-3.1* — *2017* — Quantitative interpretation of time-resolved coherent anti-Stokes Raman spectroscopy with all Gaussian pulses

G. O. Ariunbold and N. Altangerel, J. Raman Spectrosc. 48, 104 (2017)

Coherent Opt. Phenom IF-NA — *2016* — Invited review: Coherent anti-Stokes Raman spectroscopy: Understanding the essentials

G. O. Ariunbold and N. Altangerel, Coherent Opt. Phenom., Invited Review, 3, 6 (2016)

Opt. Commun. *IF-2.3* — *2015* — Observing the transition from yoked superfluorescence to superradiance

Z. Yi, P. K. Jha, L. Yuan, D. V. Voronine, **G. O. Ariunbold**, et al., Opt. Commun. 351, 45 (2015)

J. Mod. Opt. *IF-1.3*	*2015*	Complex Line Shapes in Surface-Enhanced Coherent Raman Spectroscopy D. V. Voronine, A. M. Sinyukov, X. Hua, E. Munusamy, **G. O. Ariunbold**, et al., J. Mod. Opt., 62, 90 (2015)
New J. Phys. *IF-3.7*	*2014*	Pulsed cooperative backward emissions from non-degenerate atomic transitions in sodium J. Thompson, C. Ballmann, H. Cai, Z. Yi, Y. Rostovtsev, A. Sokolov, P. Hemmer, A. Zheltikov, **G. O. Ariunbold** and M.O. Scully, New J. Phys. 16, 103017 (2014)
Laser Phys. Lett. *IF-1.7*	*2014*	All-fiber ultralow-energy soliton management at 1.55 micrometre I.V. Fedotov, A.A. Voronin, N. Altangerel, S. Blakley, H. Perez, **G. O. Ariunbold** and A. M. Zheltikov, Laser Phys. Lett., 11, 125801 (2014)
Phys. Rev. A *IF-3.0*	*2014*	Raman conversion in intense femtosecond Bessel beams in air M. Scheller, X. Chen, **G. O. Ariunbold**, et al., Phys. Rev. A 89, 053805 (2014)
Appl. Phys. Lett. *IF-4.0*	*2014*	Ultrafast laser control of backward superfluorescence towards standoff sensing **G. O. Ariunbold,** V. A. Sautenkov, and M. O. Scully, Appl. Phys. Lett. 104, 021114 (2014)
Opt. Lett. *IF-3.6*	*2012*	Temporal coherent control of superfluorescent pulses **G. O. Ariunbold**, V. A. Sautenkov, and M. O. Scully, Opt. Lett., 37, 2400, (2012)
Phys. Rev. A *IF-3.0*	*2012*	Tracking of Molecular Wave-Packets in Cesium Dimers using Coherent Raman Scattering L. Yuan, D. Pestov, R. K. Murawski, **G. O. Ariunbold**, et al., 86, 023421, Phys. Rev. A (2012).
Opt. Express. *IF-3.8*	*2012*	Third and fifth harmonic generation by tightly focused femtosecond pulses at 2.2 μm wavelength in air **G. O. Ariunbold**, P. Polynkin and J. V. Moloney, Opt. Express, 20, 1662 (2012)
Phys. Rev. A *IF-3.0*	*2012*	Superradiance in a Three-Photon Resonant Medium **G. O. Ariunbold**, W. Yang, A. V. Sokolov, V. A. Sautenkov, and M. O. Scully, 85, 023424, Phys. Rev. A (2012)
Phys. Lett. A *IF-2.7*	*2012*	Quantum fluctuations of superfluorescence delay observed with ultrashort optical excitations **G. O. Ariunbold**, V. A. Sautenkov, and M. O. Scully, Phys. Lett. A, 376, 335 (2012)
JOSA B *IF-2.1*	*2011*	Picosecond UV pulses Produced by Coherent Scattering of IR Femtosecond Pulses **G. O. Ariunbold**, M. M. Kash, V. A. Sautenkov, H. Li, Y. V. Rostovtsev, G. R. Welch, and M. O. Scully, JOSA B, 28, 515 (2011)
JOSA B *IF-2.1*	*2011*	Switching from a Sequential Transition to Quantum Beating in Atomic Rubidium Pumped by a Femtosecond Laser **G. O. Ariunbold**, V. A. Sautenkov, and M. O. Scully, JOSA B, 28, 462 (2011)
Phys. Rev. A	*2010*	Observation of Picosecond Superfluorescent Pulses in Rubidium Vapor

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G. O. Ariunbold, M. M. Kash, V. A. Sautenkov, H. Li, Y. V. Rostovtsev, G. R. Welch, and M. O. Scully, Phys. Rev. A, 82, 043421 (2010)

Phys. Rev. A *2010* Femtosecond Wave-Packet Dynamics in Cesium Dimers Studied through Controlled Stimulated Emission
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L. Yuan, **G. O. Ariunbold**, R. K. Murawski, D. Pestov, X. Wang, V. A. Sautenkov, A. V. Sokolov, Y. V. Rostovtsev, and M. O. Scully, Phys. Rev. A 81, 053405 (2010)

J. Mod. Opt. Spec. Iss. *2010* Intensity correlations and anticorrelations in coherently driven atoms
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G. O. Ariunbold, Y. V. Rostovtsev, V. A. Sautenkov and M. O. Scully Special issue: Festschrift in Memory of Lorenzo M. Narducci, J. Mod. Opt. 57 1417 (2010)

App. Opt. *2009* Propagation of femtosecond laser pulses through water in the linear absorption regime
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L. M. Naveira, B. D. Strycker, J. Wang, **G. O. Ariunbold**, A. V. Sokolov, and G. W. Kattawar, App. Opt. 48 1828 (2009).

J. Mod. Opt. *2008* A model experiment for Stand-Off Sensing
IF-1.3

G. O. Ariunbold, M. M. Kash, H. Li, V. A. Sautenkov, Y. V. Rostevtsev, G. R. Welch, and M. O. Scully, J. Mod. Opt. 55, 3273 (2008)

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T. S. Varzhapetyan, H. Li, **G. O. Ariunbold**, V. A. Sautenkov, Y. V. Rostevtsev, and M. O. Scully, Opt. Commun. 282, 39 (2008)

JOSA B *2008* Pulse shaping for mode-selective ultrafast coherent Raman spectroscopy of highly scattering solids
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D. Pestov, X. Wang, R. K. Murawski, **G. O. Ariunbold**, V. A. Sautenkov, and A. V. Sokolov, J. Opt. Soc. Am. B, 25, 768 (2008)

PNAS *2007* Single-shot Detection of Bacterial Endospores via Coherent Raman Spectroscopy
IF-12.8

D. Pestov, X. Wang, **G. O. Ariunbold**, R. K. Murawski, V. A. Sautenkov, A. Dogariu, A. V. Sokolov, and M. O. Scully, Proc. Natl. Acad. Sci. U.S.A. 105, 422 (2007)

Opt. Lett. *2007* Coherent versus incoherent Raman scattering: molecular coherence excitation and measurement
IF-3.6

D. Pestov, **G. O. Ariunbold**, X. Wang, R. K. Murawski, V. A. Sautenkov, A. V. Sokolov, and M. O. Scully, Optics Letters 32 (2007), pp. 1725-1727. [selected for the August 2007 issue of Virtual Journal of Ultrafast Science]

Science *2007* Optimizing the Laser-Pulse Configuration for Coherent Raman Spectroscopy
IF-63.7

D. Pestov, R. K. Murawski, **G. O. Ariunbold**, X. Wang, M. Zhi, A. V. Sokolov, V. A. Sautenkov, Y. V. Rostovtsev, A. Dogariu, Y. Huang, and M. O. Scully, Science 316 (2007), pp. 265-268. [Highlights on photonics spectra], [Princeton University news], [Science Daily], [A perspective given by Dr. Robert Lucht in SCIENCE Magazine]

Phys. Chem. A *2004* Nanosecond Dynamics of Single-Molecule Fluorescence Resonance Energy Transfer
IF-2.9

G. O. Ariunbold, G. S. Agarwal, Z. Wang, M. O. Scully, and H. Walther, Phys. Chem. A, 108, 2402 (2004)

Phys. Rev. A *IF-3.0* — *2004* — Nonclassical Imaging for a Quantum Search of Trapped Ions

G. S. Agarwal, **G. O. Ariunbold**, J. von Zanthier and H. Walther, Phys. Rev. A, 70, 063816 (2004) [selected for the January 2005, Vol. 5, 1 issue of Virtual Journal of Quantum Information]

J. Mod. Opt. *IF-1.3* — *2001* — Nonclassical behavior and switching in Kerr nonlinear couplers

G. Ariunbold and J. Perina, J. Mod. Opt. 48, 1005, (2001)

Opt. Commun. *IF-2.3* — *2014* — Quantum statistical properties of contradirectional Kerr couplers

G. Ariunbold and J. Perina, Opt. Commun. 176, 149 (2000)

Acta Phys. Slov. Spec. Iss. IF-0.5 — *2000* — Pair-atomic effects in the micromaser

G. Ariunbold, J. Perina and Ts. Gantsog, Special Issue on Quantum Optics and Quantum Information, Acta Phys. Slov. 50, 507 (2000)

Phys. Rev. A *IF-3.0* — *1999* — Two-mode correlated states in cavity with injected atoms

G. Ariunbold, J. Perina, Ts. Gantsog and F.A.A. El-Orany, Acta Phys. Slov. 49, 627 (1999)

J. Opt. B *IF-2.5* — *1999* — Nonclassical states in cavity with injected atoms

G. Ariunbold, J. Perina and Ts. Gantsog, J. Opt. B: Quantum Semiclass. Opt. 1, 219 (1999)

Acta Phys. Slov. Spec. Iss. IF-0.5 — *1998* — Holstein-Primakoff SU(1,1) coherent state in the micromaser under intensity dependent Jaynes-Cummings interactions

G. Ariunbold, J. Perina and Ts. Gantsog, Special Issue on Quantum Optics and Quantum Information, Acta Phys. Slov. 48, 315 (1998).

CONFERENCE PROCEEDINGS WITH REVIEW COMMITTEE

OPTICA Congress — *2022* — A Statistical Chemical Analysis for Fixed Tissues

B. Semon, M. Jaffe, H. Tsukamoto, L. Lu, and **G. O. Ariunbold**, The 2022 Imaging and Applied Optics Congress, 11-15 July 2022. ITh3D. Presented by B. Semon

OPTICA ECBO — *2021* — Rapid, Contact-Free, Multimodal, Non-Linear Optical Imaging for Collagen in Formalin-Fixed Paraffin-Embedded Tendon Tissues

B. Semon, A. Chriat, H. Wang, L. Priddy, L. Lu, M. Jaffe and **G. O. Ariunbold**, ECBO 2021 European Conferences on Biomedical Optics, June 20-24, 2021 (SPIE and OSA). Presented by B. Semon

OPTICA Congress — *2021* — Chemical Sensing via Resonant Deferred Signal Buildup

G. O. Ariunbold, B. Semon and S. Nagpal, The OSA Optical and Sensing Congress, 19- 23 July 2021. AW5G.5. Presented by G. O. Ariunbold

OPTICA CLEO — *2020* — Cooperative Emissions from Hydrogen-Bonded Heterocyclic Organic Compounds

G. O. Ariunbold, B Semon, S Nagpal, and Y Rostovtsev, CLEO: Applications and Technology, (OSA, 2020), AW4K.4. Presented by G. O. Ariunbold

OPTICA CLEO *2018* Development of a Laser-induced Fluorescence Sensor Module used with Unmanned Aerials Vehicles

S. Nagpal, P. Adhikari, W. P. Williams, G. Windham, G. A. Matthews, and **G. O. Ariunbold,** CLEO 2018 OSA Technical Digest (online) (OSA, 2018), STu4P.5. Presented by S. Nagpal

OPTICA FiO *2018* Vibrational Spectroscopic Preliminary Study of Blood and Its Components in Mice

G. O. Ariunbold, S. Nagpal, P. Adhikari, E. Purevjav and L. Lu, in Frontiers in Optics 2018, OSA Technical Digest (online) (OSA, 2018), JTu2A.127. Presented by G. O. Ariunbold

OPTICA FiO *2018* Standoff microparticles characterization with digital holographic Raman spectroscopy

N. R. Subedi, **G. O. Ariunbold**, P. Adhikari, and M. J. Berg, in Frontiers in Optics 2018, OSA Technical Digest (online) (OSA, 2018), JTu2A.111. Presented by G. O. Ariunbold

OPTICA FiO *2017* Integrated Raman Spectroscopy with Digital Holography for Microparticle Characterization

N. R. Subedi, P. Adhikari, and **G. O. Ariunbold**, in Frontiers in Optics 2017, OSA Technical Digest (online) (OSA, 2017), FTh4B.4. Presented by G. O. Ariunbold

OPTICA CLEO *2016* Early, in vivo Detection of Abiotic Plant Stress Responses via Raman Spectroscopy

N. Altangerel, **G. O. Ariunbold**, C. Gorman, D. Bohlmeyer, J. Yuan, P. Hemmer, and M.O. Scully, CLEO 2016 OSA Technical Digest (online) (OSA, 2016), SF1H.3. Presented by G. O. Ariunbold

OPTICA CLEO *2016* Coherent Stokes Raman Spectroscopy of Pyridine in Gas-Phase at Low Temperature

N. Altangerel, **G. O. Ariunbold**, Z. Yi, T. Begzjav, E. Ocola, J. Laane, and M.O. Scully, CLEO 2016 OSA Technical Digest (online) (OSA, 2016), JTu5A.147. Presented by N. Altangerel

OPTICA CLEO *2010* A Rapid Inspection of Quantum Interference using Superfluorescent Picosecond Pulses

G. O. Ariunbold, V. A. Sautenkov, and M. O. Scully, CLEO 2010 OSA Technical Digest (online) (OSA, 2010), CMA4. Presented by G. O. Ariunbold

OPTICA CLEO/QELS *2010* Controlling Directionality of Mirror-less Lasing by Pulse Shaping and Timing

A. V. Sokolov, **G. O. Ariunbold**, X. Wang, and M. O. Scully, CLEO/QELS: Laser Science to Photonic Applications, 2010 OSA Technical Digest (online) (OSA, 2010), QWA2. Presented by A. V. Sokolov

OPTICA FiO *2008* Model Experiment for Stand-off Sensing

G. O. Ariunbold, M. M. Kash, H. Li, V. Sautenkov, Y. Rostovtsev, G. R. Welch, and M. O. Scully, in Frontiers in Optics, OSA Technical Digest (CD) (OSA, 2008), FThO6, October 19, 2008, Rochester, NY. Presented by G. O. Ariunbold

OPTICA CLEO/QELS *2007* Monitoring Vibrational Wave Packet Dynamics via Direct Femtosecond Pump-Probe Measurements

D. Pestov, **G. O. Ariunbold**, et al., Tech. Dig., CLEO/QELS, May 2007, Baltimore, MD. JTHD34. Presented by D. Pestov

OPTICA CLEO/QELS *2007* Hybrid of Frequency and Time Resolved CARS

D. Pestov, R. K. Murawski, **G. O. Ariunbold**, et al., Tech. Dig., CLEO/QELS, May 2007, Baltimore, MD. CThY6. Presented by D. Pestov.

OPTICA CLEO/QELS *2007* Detection of B. subtilis spores via Hybrid CARS

D. Pestov, R. K. Murawski, **G. O. Ariunbold**, et al., Tech. Dig., CLEO/QELS, May 2007, Baltimore, MD. PTuB4. Presented by D. Pestov.

OPTICA CLEO/QELS *2006* From EIT photon correlations to Raman anti-correlations in coherently prepared Rb vapor

V. A. Sautenkov, **G. O. Ariunbold**, Y. V. Rostovtsev, and M. O. Scully, Tech. Dig., CLEO/QELS, May 2006, Long Beach, CA. QMD2. Presented by V. A. Sautenkov.

INVITED TALKS

MSU	*2022*	Quantum Particles in A "Synchronized Dance": A New Look at Old Problems and Emergent Behaviors in Complex Networks of Atoms, Molecules and Excitons Colloquium, Department of Physics and Astronomy, February 4, 2022
MSU	*2021*	Lecture on Femtosecond Laser and Its Applications to PH1001 Introduction to Physics, November 19, 2021
MPS	*2021*	Keynote speaker, Annual meeting, Mongolian Physical Society, November 11, 2021
We Can Do It	*2020*	"We Can Do It" Disability nonprofit meeting, Ulaanbaatar, Mongolia, January 4, 2020
University of Memphis	*2019*	University of Memphis, TN, February 8, 2019
University of North Texas	*2018*	University of North Texas, Denton, TX, September 14, 2018
University of Tennessee	*2018*	University of Tennessee Health Science Center, May 9, 2018
TSU	*2017*	Department of Mathematics and Physics, Tennessee State University, October 27, 2017
MSU	*2017*	Journal Club meeting, January 20, 2017
MSU	*2017*	Material Science Working Group, MSU, August 17, 2017
U of A	*2017*	Prof. Khanh Kieu's research group, College of Optical Sciences, University of Arizona, March 16, 2017
MSU	*2016*	Institute for Genomics, Biocomputing & Biotechnology (IGBB) and Mississippi Agriculture and Forestry Experiment Station (MAFES), February 24, 2016
MSU	*2016*	Department of Chemistry, January 22, 2016
TAMU	*2015*	Institute of Quantum Studies and Engineering, December 18, 2015
NIST	*2015*	Prof. M. Cicerone's research group at the National Institute of Standard and Technology, MD, September 18, 2015.
FQMT	*2013*	Frontiers of Quantum and Mesoscopic Thermodynamics Conference, Prague, Czechia, 30 July 2013

The 4th IMFP	*2013*	The 4th International Meeting on Frontiers of Physics, Pahang, Malaysia, 27 August - 30 August 2013
Palacky University	*2013*	Department of Optics, Palacky University, and Quantum Optics Laboratory, Olomouc, Czechia, 31 July 2013
University High School	*2013*	Shine-Mongol High School, Ulaanbaatar, Mongolia, April 2, 2013
NUMOSA	*2013*	OSA Student Chapter, National University of Mongolia, April 18, 2013
NUM	*2013*	School of Physics and Electronics, National University of Mongolia, February 20, 2013
AFOSR	*2011*	Air Force of Science Research (AFOSR): Non-Linear Optics Meeting", Albuquerque, New Mexico, October 18-20, 2011
NUM	*2004*	National University of Mongolia, Ulaanbaatar, December 14, 2004
University of Vienna	*2004*	Prof. A. Zeilinger's research group. University of Vienna, Austria, November 15, 2004
University of Kaiserslautern	*2004*	Prof. K. Bergmann's research group, University of Kaiserslautern, Germany, October 8, 2004
University of Ulm	*2004*	Prof. W. Schleich's research group, University of Ulm, Germany, September 22, 2004
MPQ for the Science of Light	*2004*	Prof. G. Leuch's research group, Max Planck Institute for the Science of Light, Erlangen, Germany, July 31, 2004
MPQ of Quantum Optics	*2004*	Prof. I. Cirac's group, Max-Planck Institute of Quantum Optics, Munich, Germany, May 19, 2004

CONTRIBUTED TALKS

PQE	*2006, 2008-2010, 2014, 2015*	36, 38, 39, 40, 44 and 45th Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah
Summer School	*2005, 2007, 2009, 2010, 2013-2015*	Summer School on Quantum Optics, Casper/Jackson Hole, Wyoming
Princeton University	*2014*	Second Princeton workshop on Classical, Semi-classical and Quantum Noise, Princeton University, March 21-23, 2014
Princeton University	*2005*	Symposium on Bose Einstein Condensations, Princeton, New Jersey, 14-15 October 2005
German Physical Society	*2004*	Annual Meeting of the German Physical Society, Munich, Germany, March 22-26, 2004

TEACHING ACTIVITIES

MSU — *Spring 2022* — Instructor of Record for PH2213: Physics I

I taught the undergraduate level Physics I course (for physics and engineering majors) at Mississippi State University in Spring 2022. Student evaluation: NA (due to the change in scoring format)

MSU *Fall 2021* Instructor of Record for PH4323/6323: Electromagnetic Fields I
I taught the split-level graduate and undergraduate Electromagnetic Fields I course (for physics and engineering majors) at Mississippi State University in Fall 2021. Student evaluation: NA due to the change in scoring format

MSU *Spring 2021* Instructor of Record for PH2233: Physics III
I taught the undergraduate level Physics III course (for physics and engineering majors) at Mississippi State University in Fall 2017. On my student evaluations, I received a global index average of 4.3±1.4

MSU *Fall 2020* Instructor of Record for PH2233: Physics III
I taught the undergraduate level Physics III course (for physics and engineering majors) at Mississippi State University in Fall 2017. On my student evaluations, I received a global index average of 4.1±0.8

MSU *Spring 2020* Instructor of Record for PH4333/6333: Electromagnetic Fields II
I taught the split-level Electromagnetic Fields II course (for physics and engineering majors) at Mississippi State University in Spring 2016. On my student evaluations, I received a global index average of 4.7±0.5.

MSU *Fall 2019* Instructor of Record for PH2213: Physics I
I taught the undergraduate level Physics I course (for physics and engineering majors) at Mississippi State University in Spring 2019. On my student evaluations, I received a global index average of 3.6±1.2

Instructor of Record for PH4323/6323: Electromagnetic Fields I
I taught the split-level graduate and undergraduate Electromagnetic Fields I course (for physics and engineering majors) at Mississippi State University in Fall 2019. On my student evaluations, I received a global index average of 4.4±0.3.

MSU *Spring 2019* Instructor of Record for PH2213: Physics I
I taught the undergraduate level Physics I course (for physics and engineering majors) at Mississippi State University in Spring 2019. On my student evaluations, I received a global index average of 3.5±1.0

MSU *Fall 2018* Instructor of Record for PH4323/6323: Electromagnetic Fields I
I taught the split-level graduate and undergraduate Electromagnetic Fields I course (for physics and engineering majors) at Mississippi State University in Fall 2018. On my student evaluations, I received a global index average of 4.5±0.7.

MSU *Spring 2018* Instructor of Record for PH2233: Physics III
I taught the undergraduate level Physics III course (for physics and engineering majors) at Mississippi State University in Spring 2018. On my student evaluations, I received a global index average of 3.5±1.1.

MSU *Fall 2017* Instructor of Record for PH8313: Electromagnetic Theory I
I taught the graduate level graduate Electromagnetic Theory I course (for physics and engineering majors) at Mississippi State University in Fall 2017. On my student evaluations, I received a global index average of 3.1±1.3

MSU *Spring 2017* Instructor of Record for PH1123: Physics II (Non-calculus based)
I taught the undergraduate level General Physics II (non-calculus based) course (for non-physics majors) at Mississippi State University in Spring 2017. On my student evaluations, I received a global index average of 3.6±0.9

MSU *Fall 2016* Instructor of Record for PH8313: Electromagnetic Theory I
I taught the graduate Electromagnetic Theory I course (for physics and engineering majors) at Mississippi State University in Fall 2016. On my student evaluations, I received a global index average of 3.7±1.3

MSU *Spring 2016* Instructor of Record for PH4333/6333: Electromagnetic Fields II
I taught the split-level Electromagnetic Fields II course (for physics and engineering majors) at Mississippi State University in Spring 2016. On my student evaluations, I received a global index average of 4.7±0.5.

MSU *Fall 2015* Instructor of Record for PH8313: Electromagnetic Theory I
I taught the graduate level graduate Electromagnetic Theory I course (for physics and engineering majors) at Mississippi State University in Fall 2015. On my student evaluations, I received a global index average of 2.9±1.7

NUM	*Fall 2014*	Ultrafast and nonlinear optics, online graduate course (for physics majors)
NUM	*Spring 2014*	The Fundamentals of Photonics, online course undergraduate (for physics majors)
NUM	*Spring 2000, 2001*	Quantum Optics, undergraduate level (for physics majors)
NUM	*Fall 1996, 2001, 2002*	Electromagnetic Theory, undergraduate level (for physics majors)
NUM	*Spring 2001, 2002*	Analytical Mechanics, undergraduate level (for physics majors)
NUM	*Spring 2001*	Quantum Chemistry, undergraduate level (for chemistry majors)
NUM	*Fall 2001, 2002*	Quantum Mechanics, undergraduate level (for physics majors)

PATENT

TAMU *2007-* Dmitry Pestov, Alexei V. Sokolov, Marlan O. Scully, Robert Murawski, **Ariunbold Gombojav**, Xi Wang, Vladimir Sautenkov, *Hybrid technique for Coherent Anti-Stokes Raman Spectroscopy*. W0200905880 5A1.