Dr. John Burke - Principal Director for Quantum Science for the Office of the Undersecretary of Defense for Research and Engineering (OUSD (R&E)) for Science and Technology (S&T) (OUSD (R&E)) for Science and Technology (S&T) as the Principal Director for Quantum Science in March 2022. In this role, Dr. Burke was responsible for leading the Department of Defense's (DoD) strategy for quantum science, one of DoD's top critical technology areas.

Prior to joining OUSD (R&E), Dr. Burke served as a Defense Advanced Research Projects Agency (DARPA) Program Manager in the Microsystems Technology Office (MTO) and Defense Sciences Office (DSO) from 2017 to 2022. At DARPA, he managed seven programs developing quantum science and technology. Some of these programs advanced quantum sensors including atom interferometers, atomic clocks, magnetometers, and radio frequency (RF) "Quantum Apertures" and applied the sensors toward new capabilities in position, navigation and timing (PNT), biotechnology, as well as in the RF spectrum. Several programs advanced quantum computing qubit technologies based on both superconducting and photon-based platforms. This work resulted in several technology transitions to higher maturity development programs across the DoD, as acknowledged by his receipt of the DARPA "Results Matter" Award.

Previously, Dr. Burke worked in the Air Force Research Laboratory (AFRL) Space Vehicles Directorate as a Senior Research Physicist. There, Dr. Burke led a research team developing atomic clocks, optical time transfer, and cold atom measurement techniques for use in space applications such as the Global Positioning System. He contributed to space experiments including the NASA Cold Atom Laboratory for the International Space Station and the Navigation Technology Satellite -3. Dr. Burke won the AFRL Early Career Award and R-NASA National Award for Space Achievement in recognition for his contributions, multiple publications, and patents.

Dr. Burke holds a Bachelor of Science degree in Physics from Centre College and a Doctorate of Philosophy degree in Physics from the University of Virginia. His thesis work was on atom interferometry with guided matter waves sourced from a Bose Einstein Condensate, which won the University of Virginia Award for Excellence in Scholarship in Science and Engineering.

Dr Michael Slocum is a researcher and program manager at AFRL Materials and Manufacturing directorate. He leads multiple internal and external initiatives developing and maturing quantum sensors for DAF applications, specializing primarily in magnetic sensing. He graduated with his PhD and BS degrees from Rochester Institute of Technology.

Topic Description
This talk will be a high-level overview of quantum sensors developed within AFRL, which include NV magnetometers, optical atomic clocks, novel inertial measurement systems, and photonic system elements to enable next-generation low-SWaP sensors. In addition to sensor development the talk will highlight sensor and system demonstration efforts that validate the DAF utility of advanced quantum sensors.

Dr. Neil Claussen – Manager of the Atomic/Optical Sensing Department at Sandia National Labs. Expertise is in remote sensing with classical and quantum-based sensors, specializing in magnetic sensing. Previously, a scientist at Naval Surface Warfare Center Panama City Division and an engineer at Precision Photonics in Boulder, CO.

Topic Description

Overview of Quantum Sensing at Sandia representing my staff who develop sensors including magnetometers, atomic clocks, and atom interferometers.

Dr. Geetha Senthil, Ph.D., MS - Deputy Director Office of Special Initiatives National Center for Advancing Translational Sciences National Institutes of Health. She began her career at NIH Office of the Director (OD) in 2007 as Scientific Portfolio and Policy Analyst at the Office of Portfolio Analysis in the Division of Program Coordination, Planning, Strategic Initiatives (DPCPSI). Prior to joining NCATS, she worked at National Institute of Mental Health (NIMH) for over a decade in various leadership roles including Acting Director in the Office of Genomics Research Coordination, Program Director, and co-lead of Genomics Team. In these roles, she established and managed several multidisciplinary consortia programs in postmortem human brain functional genomics and rare genetic diseases - Genes2MentalHelath Network. She was also involved in developing and managing several NIH Common fund Programs' projects. Prior to NIMH, she also worked at the US Food and Drug Administration (FDA) as Regulatory Project Manager for Clinical Trials in the Office of Biostatistics and Epidemiology, Center for Biologics Research (CBER).

She obtained her Ph.D. in Molecular Genetics from the University of Dundee in Scotland, UK. Her post-doctoral research was in the areas of neurogenetics and genetics of host-pathogen interactions. She published numerous peer-reviewed papers and achieved several NIH awards for her contributions to NIH programs. Senthil is enthusiastic to bring innovative solutions to translating biomedical research to improving public health. She is keen on exploring cross-cutting opportunities in developing innovative technologies applicable to biomedical fields through leveraging resources, expertise, and partnerships across NIH ICs, federal agencies, national and international stakeholders.

Topic Description

She will be presenting Quantum Sensing Applications for biomedical domains. She co-leads the SMaHT - Somatic Mosaicism across Human Tissues Common Fund program and serves as the lead Program Officer for the Tissue Procurement Center, and as a Project Scientist for Data Generation Projects in Bridge2AI Common Fund program. She leads lead the Trans-NIH working group on quantum information sciences (QIS) and co-leads Trans-NIH Quantum Information Special Interest Group to facilitate coordinating efforts between the NIH ICs and federal agencies such as NSF, DOE, and NIST to help identify opportunities in QIS applicable to biomedical domains and the potential for quantum computing for biomedical and data science applications.

Dr. Robert Stirbl directs NASA/JPL/Caltech's National Defense Programs Office. Since 1996 he's both managed & technically contributed to advanced prototype concept design, development and adaptation of NASA and DoD funded JPL-unique Quantum/EO/IR sensor and AI technologies for insertion into Navy, Army, USAF/SF, SOCOM, MDA, DTRA, TRMC, NASA, & industrial applications. He received his Ph.D/EE at the Graduate Center/City University of New York in 1981. He has taught courses in quantum- and electro-optical system design at N.Y.U. School of Graduate Studies, Pratt Institute, The City College of New York and was a Professor of Electrical Engineering at Manhattan College.

Topic Description

NASA's Quantum Innovation Center; Powering future NASA Science Missions with Quantum Sensing

"The presentation will cover a summary of the recently established NASA Quantum Innovation Center (QIC), its background, accomplishments to date, as well as efforts and goals towards a collaborative structured architecture, with JPL serving as a trusted government entity. The talk will cover JPL's unique space quantum sensing expertise and its development of key quantum application technologies and goals, that include but are not limited to: having JPL attract new talented students and researchers from international and domestic universities, while leading the Quantum Gravity Gradiometer technology demo mission under the Earth Science Division (ESD) of NASA's Space Missions Directorate (SMD) while working with international organizations, industry, and GSFC. In addition, QIC at JPL will serve as the focal point for NASA activities in space quantum research leveraging a skilled workforce and facilities, to develop SOA research prototypes, capabilities, and equipment to enable future NASA science missions via developing and leveraging the unique benefits of quantum sensing, quantum communications, quantum computing and quantum networks, for precision space navigation. The QIC will also coordinate and leverage the talents & capabilities of other NASA center partners and non-NASA stakeholder investments in developing quantum technologies in order to accelerate developments for space applications and create a hub in Southern California in order to establish a pipeline of students and researchers for spaceborne missions (Caltech, UCSB, UCSD, UCLA, USC). For the next 2 decades, JPL will, under QIC, advance quantum technologies in enabling mass change science for Earth, planetary and dark energy/dark matter detection for Astrophysics and Biological & Physical Science (BPS).
In order to accomplish these goals, JPL and NASA has establish this QIC to develop new quantum technologies and to be a FFRDC partner of choice for mission formulation based on quantum sensing employing JPL unique staffing and facilities to meet the current needs and will acquire new diverse talents by capturing new opportunities from NASA and reimbursable sponsors in the future applications of Quantum Systems in Space.".

Dr. Michael Larsen - Michael Larsen received his Ph.D. in physics from the University of Wisconsin, Madison in 2007. He is currently the Quantum Science Architect in Northrop Grumman's Emerging Capabilities Development organization. Dr. Larsen's focus is the application of atomic physics to the development of high performance, rugged, and compact sensors. His team's projects include the development of inertial sensors, electromagnetic sensors, and clocks as well as their applications to DoD missions.

Topic Description

Message from the QED-C Steering committee and an overview of Quantum Sensing at Northrup Grumman.

Dr. Christopher L. Holloway - National Institute of Standards and Technology - NIST Fellow and an IEEE Fellow and has been at NIST for over 25 years. He is also on the Graduate Faculty at the University of Colorado at Boulder. He is an expert in electromagnetic theory and metrology, quantum-optics, Rydberg-atom systems, and atom-based sensors. He has a publication h-index of 64 with over 350 technical publications and has over 16,200 citations of his papers. He has 10 patents in various fields in engineering and physics. He is the Project Leader for the Rydberg-Atom-Sensor Project and is the Group Leader for the Electromagnetic Fields Group.

Topic Description - "Rydberg atom-based sensors: Transforming measurements and detection of radio-frequency fields and time-varying signals - The unique properties of Rydberg atom-based sensors allow for intriguing applications. For example, Rydberg atom receivers allow for the detection and receiving of time-varying fields and communication signals without an antenna and front-end electronics. One of the keys to developing new science and technologies is to have sound metrology tools and techniques. Atom-based measurements allow for direct International System of Units (SI) traceable measurements, and as a result, measurement standards have evolved towards atom-based measurements over the last few decades; most notably length (m), frequency (Hz), and time (s) standards. Recently, there has been a great interest in extending this to magnetic (H), electric (E), and other physical quantities. The development of Rydberg atom-based sensors has allowed for SI-traceable measurements for these quantities. With the great progress in the development of Rydberg atom-based sensors, interesting and unforeseen applications are emerging. These applications include, (1) SI-traceable measurements for electric field and power, (2) amplitude and phase detection of time-varying signals, (3) angle-of-arrival, (4) waveforms and spectrum analyzers, (5) plasma sensors, (6) near-field and sub-wavelength imaging, (7) blackbody detection and thermometry, (8) DC/AC voltage measurements, and many others. One of the more intriguing applications for Rydberg atom-based sensors is in the detection of time-varying signals. These atom-based receivers allow for the detection of amplitude-, frequency-, and phase-modulated signals. In fact, in receiver applications, these Rydberg-atom sensors act like an antenna (to detect the signal) and they perform the demodulation and down conversion automatically. That is, these Rydberg receivers can eliminate a lot of the front-end devices and electronics when compared to conventional receivers.

In this talk, we will present a historical journey of the development of this technology, and in the process, we will summarize this work and discuss various applications.

Dr. Danielle A. Braje leads the quantum sensing and ion efforts in the *Quantum Information and Integrated Nanosystems Group* at Lincoln Laboratory. Her research applies the fundamental properties of quantum systems to the sensing and computing arenas, focused on technology for national security. Her research portfolio includes ion qubits for quantum computing and clocks as well as solid-state ferrimagnetic systems and defects in diamond for quantum sensors.

Prior to Lincoln Laboratory, Dr. Braje was a faculty member at Reed College working in coherent effects in laser-cooled atoms and a research scientist at NIST Boulder developing compact laser frequency combs.

Dr. Braje has published more than 100 peer-reviewed journal articles, is inventor or co-inventor on several patents, and has received an R&D100 award. Dr. Braje earned her PhD degree in applied physics from Stanford University as a Hertz Fellow and her BS degree in physics from the University of Arizona.

Topic Description

Overview of Quantum Sensing at MIT-LL representing my staff who develop sensors including magnetometers, atomic clocks, and atom interferometers.

Dr. James Camparo - Dr. Camparo joined The Aerospace Corporation's Atomic Physics section in January 1981 immediately after obtaining his doctorate from Columbia University. He is currently a Fellow in Aerospace's Physical Sciences Laboratories, where his interests include research and development of the laser-pumped atomic clock, the study of atomic timekeeping onboard spacecraft, and experiments investigating the field/atom interaction. Dr. Camparo is the author or co-author of over 100 scientific papers, and he holds eight patents in the area of atomic clocks. Dr. Camparo has been a part-time faculty member at California State University Dominguez Hills, lecturing in both the Physics and Chemistry departments, and an adjunct professor of physics at Whittier College.

Topic Description

Quantum Timekeeping in Space - In 1945, during the Richtmeyer Memorial Lecture at the annual meeting of the American Physical Society in New York City, Nobel Laureate I. I. Rabi made the first suggestion for a clock based on atoms. A device where the "tick-rate" of the clock is tied to the fundamental stability of atomic structure. Twelve years later the first atomic clock was realized, and in 1975 the first atomic clock was launched into space. In the nearly half-century since that first space flight, atomic clocks have become more precise and more resilient, and as a result have proliferated into diverse space systems. In this presentation, I will provide a very brief history of atomic clocks in space, focusing on two types of space mission that require precise timekeeping: satellite communications (SatCom) and satellite navigation (SatNav). I will conclude by discussing the types of atomic clocks presently flying in space, as well as two advanced space clocks that could be "mission-ready" within the next 10 years.

Dr. Giovanni Scuri - Stanford University, USA**.** A Bloch Postdoctoral Fellow in the Department of Electrical Engineering at Stanford University, working in the Nanoscale and Quantum Photonics lab under the guidance of Professor Jelena Vučković. Dr. Scuri's research combines nonlinear optics and solid-state qubits with the goal of creating hybrid quantum systems for quantum sensing, networking and simulation.

Dr. Scuri received a B.A. in Physics and Economics from Columbia University and a PhD in Physics from Harvard University. His doctoral work in the group of Professor Hongkun Park spanned the fields of condensed matter physics and quantum optics, with a focus on atomically thin semiconductors.

Topic Description:

Towards spin entanglement in distributed networks of quantum sensors for improved performance

Networks of quantum sensors are promising for applications in quantum communication, sensing of fields, and high precision metrology, including synchronizing spatially separated clocks. A major challenge towards achieving these goals is the excessive noise in the quantum states used by the sensors. Spatially distributed entanglement between quantum network nodes enables a better improvement in the noise performance of the sensors relative to spatially localized quantum sensors.

In this talk, I will discuss recent progress in our group towards creating on-chip scalable quantum systems for applications in sensing and networking. In particular, the talk will cover a platform based on the tin-vacancy center (SnV) in diamond, which has a robust spin qubit state enabling its integration into photonic structures for the creation of long-distance entanglement. Towards this goal, we recently demonstrated microwave control of the spin qubit state with high (>99.5%) fidelity and single-shot readout. Finally, I will briefly discuss other qubit platforms in solids and two-dimensional materials with applications in quantum sensing.

Dr. Ronald Walsworth is the Director of the Quantum Technology Center and a Minta Martin Professor of Physics and of Electrical and Computer Engineering at the University of Maryland. He leads an interdisciplinary research group with a focus on developing quantum sensing tools and applying them to problems in both the physical and life sciences. He has co-founded several technology companies, including Quantum Catalyzer (Q-Cat).

Topic Description:

Quantum Diamond Sensors — Best of Both Worlds

Dr. Franklyn Quinlan is a Physicist and Leader of the Precision Photonic Synthesis Group in the Time and Frequency Division at NIST in Boulder, CO. He joined NIST in 2009 as a postdoctoral researcher, partly as a National Research Council postdoctoral associate. While at NIST, his research has focused on the development of optical frequency combs and ultrastable optical frequency references, new models and measurements of noise in the photodetection of ultrashort optical pulses, optical pulse shaping, low noise microwave signal generation, and photonic interconnects to cryogenic platforms. In 2015 Dr. Quinlan was awarded the European Frequency and Time Forum Young Scientist Award for his contributions to low noise microwave generation from frequency combs and the physics of ultrashort optical pulse detection, and in 2019 the Presidential Early Career Award in Science and Engineering (PECASE) for his work on high-speed photodetection. He is a Fellow of Optica.

Topic Description:

Compact and Portable Ultrastable Lasers for Quantum Systems

Dr. Morrison is the Vice President of Engineering at Freedom Photonics, with responsibilities spanning all aspects of design, characterization, and manufacturing of photonic modules and photonic integrated circuits. In addition, he supports technology development and program management, utilizing his expertise in semiconductor and laser physics and engineering. More recently he has also led teams at Freedom Photonics in the development of lasers and sensor heads for atomic sensors including magnetometers, gyroscopes, Rydberg sensors and clocks.

Dr. Morrison is author or co-author of over 100 peer reviewed papers and holds numerous patents. Dr. Morrison is a Senior Member of the IEEE.

Topic Description:

Lasers, PICs and Packages for Quantum Sensing

Dr. Lute Maleki, Ph.D. Lute Maleki is a Founder, and President and CEO of OEwaves, Inc. The Company is focused on the development of photonic components and subsystems for advanced sensors and communication systems and quantum technology. In 2014, he co-founded and served as the CTO of Strobe, a LiDAR company spun out of OEwaves and acquired by GM/Cruise in 2017. He joined GM/Cruise for the following two years to lead the development of LiDAR sensors.

Prior to joining OEwaves in 2007, Lute was a Senior Research Scientist at the Jet Propulsion Laboratory (JPL) where he created and led the Quantum Sciences and Technologies Group. His technical areas of interest at JPL included development of atomic clocks based on ion traps and laser cooled trapped atoms; ultra-stable photonic oscillators; the opto-electronic oscillator (OEO); photonic signal distribution systems; study and development of whispering gallery mode micro-resonators and their applications; development of sensors based on atom wave interferometers; and tests of fundamental physics with atomic clocks. He is an inventor of over 70 U.S. Patents and applications, and has authored and co-authored over 130 refereed publications, and over 200 conference proceedings. Dr. Maleki is a Life Fellow of IEEE, a Fellow of the American Physical Society, and a Fellow of the Optical Society of America (now Optica). He holds B.S., M.S. and Ph.D. degrees in Physics. He received the IEEE Rabi Award, IEEE Sawyer Award and NASA's Exceptional Engineering Achievement Medal for the development of the Trapped Ion Frequency Standard.

Topic Description:

I plan to talk about ultra-low-noise lasers for quantum sensing.

Dr. Kaitlin Moore is a principal investigator and manages a group in quantum sensing in the Advanced Technology and Sciences Division at SRI, a non-profit research organization. Dr. Moore earned her Ph.D. at the University of Michigan, studying both cold and vapor-cell Rydberg-atom physics. As an NRC Fellow at NIST, Dr. Moore studied MEMS-scale cold-atom systems. Since joining SRI in 2019, Dr. Moore has led or co-led internal research programs on vapor-cell Rydberg electrometry and chip-scale photonic-cold-atom integration and has been the PI or co-PI on several external programs involving atomic sensing.

Topic Description:
Sensor assembly for scalability and fieldability while enabling functionality for a variety of atomic sensing platforms

Scott R. Davis, Ph. D., CEO and co-founder Vescent - Dr. Davis is a physicist entrepreneur with an emphasis on new technology transition from the laboratory to manufacturing. He has spent his career inventing, developing, and commercializing a wide variety of technologies. As a co-founder and VP of technology at Vescent he led the development of non-mechanical beamsteerers and oversaw the asset sale of that technology to Analog Devices for the autonomous vehicles market. He came back to Vescent as CEO in 2020. Since then, he has been leading the development of technologies and products, such as compact laser systems for trapping and cooling atoms, compact and deployable frequency combs, miniature spectroscopic standards, and other tools aimed at furthering the development and deployment of quantum systems. He has over 30 papers published, has co-authored two book chapters, and has twenty-seven patents pending and/or issued.
Topic Description:

Laser Solutions for Scaling & Deploying Quantum Technologies - When systems are engineered to relay or extend "quantum weirdness" from the *nano*scopic scale of atoms to the *macro*scopic scale of humans amazing things can happen. Twentieth century quantum systems (the transistor and the laser) ushered in the computer age and the information age. Twenty-first century quantum systems (computers, sensors, next generation timing, etc..) are emergent; the disruptive potential is tantalizing. Almost all of these nascent quantum systems require lasers and photonics, representing both an opportunity and a challenge. In this talk I will discuss the complexity of lasers-for-quantum, present the technical and economic landscape, and present paths forward for how ruggedized lasers and photonics solutions from Vescent will usher in a new quantum age. I will also present how Vescent, a spin-out of NIST and JILA, is playing a critical role in the Colorado quantum tech-hub, Elevate Quantum, to enable and accelerate the quantum 2.0 economic scale-up.