IEEE SF Bay Area MEMS and Sensors Chapter

http://sites.ieee.org/scv-mems/

MEMS revolution in Atomic Sensing
-- from Tiny Atomic Clocks to Ultra-sensitive Magnetometry

Speaker: Drs. John Kitching, NIST and Rahul Mhaskar, Geometrics, Inc..
Date/Time: Tuesday, Dec. 15rd, 2015, 6:00 pm
Location: Texas Instruments Building E Conference Center, 2900 Semiconductor Dr., Santa Clara, CA 95052
Food: Pizza and beverages will be available starting at 6:00 pm for a donation at the door.
Sponsorship: Contact sfba-mems-officers@listserv.ieee.org for sponsorship opportunities.

Abstract: Magnetic fields are everywhere, from the human body to oil and mineral exploration. Total field magnetometers based on atomic spin precession are widely used in geophysical and other surveys where the magnetic field gives an indication of the properties of the subsurface. However, existing sensors limit the wide applicability of magnetometers due to high power requirement and large deployment footprint. Consequently, technology for high-precision magnetic imaging in the ambient magnetic field using sensor arrays has lagged far behind other imaging modalities. Physicists at the National Institute of Standards and Technology (NIST) created and demonstrated a chip-scale atomic magnetometer in 2004. Recent advances in atomic spectroscopy, advanced semiconductor lasers and micro-electro-mechanical systems (MEMS) enabled a low-power, miniature total-field optical magnetometer that is amenable to volume manufacturing through silicon-based micro-fabrication processes. The design, fabrication and performance of these instruments will be described, as well as a number of applications to which the devices are well suited. The small size, low power and excellent sensitivity of these sensors enable their integration magnetic field imaging systems that can revolutionize diverse areas from geomagnetism and biomagnetism to security and remote sensing. Finally, we speculate on possible future directions for chip-scale atomic instrumentation with a focus on the use of laser-cooled atomic samples and tools for fundamental metrology.

Dr. John Kitching received his PhD. in Applied Physics from the California Institute of Technology in 1995. Since 2003, he has been a physicist in the Time and Frequency Division at NIST and currently is the Leader of the Atomic Devices and Instruments Group in NIST's Physical Measurements Laboratory. His research interests include miniaturized atomic clocks and sensors and applications of semiconductor lasers and micromachining technology to problems in atomic physics and frequency control. Most recently, he and his group pioneered the development of microfabricated "chip-scale" atomic devices for use as frequency references, magnetometers and other sensors. He is a Fellow of NIST and has received a number of awards for his work including the Department of Commerce Silver and Gold Medals, the 2009 Arthur Flemming Award, the prestigious 2013 Rank Prize. He has published over 80 papers in refereed journals, has given numerous invited and plenary talks and has been awarded six patents.

Dr. Rahul Mhaskar received his PhD in Applied Physics from the University of Michigan in 2008. Since 2013, he has been a scientist at Geometrics, Inc., a leading manufacturer of geophysical instrumentation. He leads the technology maturation and commercialization efforts on miniature atomic magnetometers at Geometrics, where he coordinated a DoD-funded project to demonstrate a real-time magnetic anomaly imaging system based on an array of miniature magnetometers. Previously, he was a postdoctoral scientist at NIST, working in the team that developed fiber-optic coupled, MEMS-fabricated atomic magnetometers capable of measuring the magnetic activity of the human brain. His professional interests span novel atomic-optical sensor development, multi-sensor magnetic imaging, digital signal processing, and technology management with a particular focus on translating atomic sensing technologies from laboratory to high-impact applications.