# RMOSA

Rocky Mountain Section of the Optical Society of America

## Joint RMOSA/IEEE-LEOS Seminar & Meeting

**Thursday, October 18, 2007**

Refreshments: 7 p.m. :: Seminar: 7:30 p.m. BUS 340 Leeds Business, CU, Boulder

# Small Time: A Chip Scale Atomic Clock

Photo by: Geoffrey Wheeler


## Dr. John Kitching

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**Abstract**: For over fifty years, atomic clocks have been recognized as the preeminent instruments for achieving precision timing of events lasting longer than a few seconds. In 1967, the second was in fact redefined to correspond to a specific number of electromagnetic oscillations of the Cesium atom. Atomic clocks impact our lives in a myriad of ways ranging from tests of fundamental theories of physics to enabling the global positioning system (GPS) and decentralized communication networks such as cellular telephone systems. We will describe recent efforts in our laboratory to miniaturize atomic clocks using techniques and processes of micro electro mechanical systems (MEMS). Our goal is to develop an atomic clock with a volume of 1 $cm^3$, a power consumption below 30 mW and a timing precision of one microsecond over one day. Such a device would enable atomically-precise timing to be used in portable, battery-operated units such as GPS receivers and wireless communication devices. In addition, related activities will be discussed including the development of chip-scale magnetometers and the coupling of magnetic, mechanically resonant microstructures to the spin degree of freedom of atoms in the gas phase.


**Bio:** Dr. John Kitching received his BSc. in physics from McGill University in 1990. He went on to obtain a MSc. and PhD. in Applied Physics from the California Institute of Technology in 1992 and 1995, respectively. His thesis topic was an investigation of amplitude and frequency noise properties of semiconductor lasers subjected to optical feedback. From 1995 to 2003, he was with JILA/ The university of Colorado and also held a guest-researcher appointment in the Time and Frequency Division at the National Institute of Standards and Technology, NIST. Since 2003, he has been a physicist in the Time and Frequency Division at NIST. His research interests include atomic systems, and applications of semiconductor lasers to problems in atomic physics and frequency control. Most recently, he and his team pioneered the development of microfabricated atomic devices for use as frequency references, magnetometers, an other sensors. He has received several awards, including the 2005 EFTF European Young Scientist Award, the 2006 ISSCC Jack Rapper Award for Outstanding Technology Directions and the Department of Commerce Silver Medal. He has published over 40 papers in refereed journals, has given numerous invited talks and has been awarded two patents.

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