

Chip-scale Atomic Devices: Miniature Precision Instruments using Atoms, Lasers and Silicon Micromachining

There is currently a strong movement worldwide toward portable, battery operated, wirelessly connected devices such as GPS receivers, cellular telephones and laptop computers and tablets. This new generation of electronics enables vast new capability, but also comes with new challenges such as bandwidth limitations, sensitivity to jamming and reduced access to calibration. A new generation of miniature, low-power, low-cost precision instruments is being developed at NIST for use in such portable technologies. These include clocks, magnetometers, gyros and wavelength references, all based on precision atomic spectroscopy and using emerging new fabrication capabilities such as microelectromechanical systems and photonics. This talk will describe the design, fabrication and performance of these instruments, as well as touch on several applications to which they are well-suited. Finally, we will speculate on future opportunities for these types of devices such as compact instruments based on laser-cooled atoms and a broader view on highly accurate chip-scale measurements.

