

# QUANTUM OPTICS SEMINAR



**Title:** Optical Lattice Clocks with Sr Atoms

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**Time:** Wednesday, May 2 at 15:15

**Place:** 1525-323

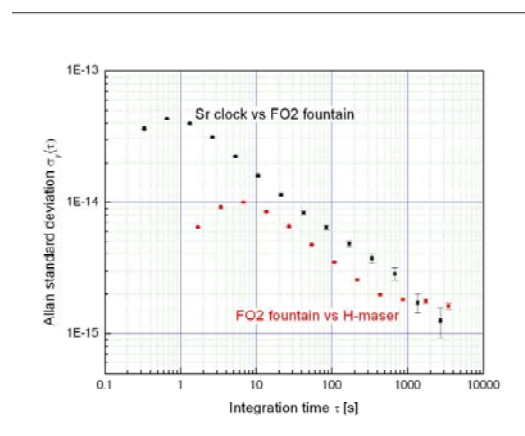
## Abstract:

Over the past few years, the extensive development of Optical Lattice Clocks (OLC) based on neutral atoms has given hope for an ultimate accuracy in the range of  $10^{-17}$ , surpassing the performances of the state-of-art atomic microwave fountains.

We report a new accuracy evaluation of the LNE-SYRTE OLC with fermionic  $^{87}\text{Sr}$  atoms. The previous accuracy budget<sup>1</sup>, in 2006, was limited by the effect of the first order sensitivity of the clock transition to the magnetic field. The interrogation is now achieved by preparing spin-polarized atoms alternately optically pumped in the  $m_F = \pm 9/2$  Zeeman substates, which strongly decreases the uncertainty on the magnetic field effects.

This work was carried out in collaboration with the PTB Institute, the frequency measurements were made with their femtosecond frequency comb based on a fiber laser<sup>2</sup>, and referenced to the three atomic fountains FO1, FO2 and FOM at LNE-SYRTE. The resulting accuracy of the  $^{87}\text{Sr}$  clock is in the low  $10^{-15}$  range. An experimental standard Allan deviation is plotted on the figure. The stability of the measurement at 1s is  $5.10^{-14}$ , with roughly equal contributions of the Sr clock and of the fountain.

We also performed the first evaluation of an OLC based on the  $^{88}\text{Sr}$  bosonic isotope, using a static magnetic field to allow the transition<sup>3</sup>. The systematic effects budget and a comparison with the fermionic isotope will also be discussed.



1. R. Le Targat et al., Phys. Rev. Lett. 97, 130801 (2006).
2. P. Kubina et al., Optics Express, 13, 904-909 (2005).
3. Z. Barber et al., Phys. Rev. Lett. 96, 083002 (2006).

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