ID de Contribution: **53** Type: **Poster**

Laser sources for trapping atoms in Sr optical lattice clock

lundi 22 février 2016 16:00 (3 heures)

Sr Opical Lattice Clocks (OLCs) are promising candidates for a compact, transportable and even potentially space optical lattice clock. The space or transport applications need a compact and reliable apparatus. One of the largest problem is a miniaturization of lattice source at 813 nm. Due to the fact that the lattice light is countinously on during a clock cycle, in major cases Titanium-Sapphire (TiSa) laser is used to generate the lattice because guarantees spectral purity at 10-18 level. Unfortunately TiSa laser occupies a lot of space (to compare with another components), hence it is not an excellent candidate for mobile OLCs. In the other hand tests carried out with compact semi-conductor sources (like laser diode and tapered amplifiers) have shown discrepancies as high as several 10-15 (for 1 Er) between several clocks. Therefore, in order to reach uncertainties in the 10-17 range, a detailed study of the different possible laser sources is necessary. Firstly we perform differential measurements on one clock, alternating between a configuration in which the lattice light is generated by the Titanium-Sapphire laser and a configuration in which the light is generated by a tapered amplifier (TA) or slave diode laser. Second we determine spectral distributions of available sources in our lab using optical spectral analyzer. These measurements allow us to determine systematic effects for all sources and test if the TA is a reliable lattice light source.

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Classification de Session: Poster session