An Unusually Ultrastable Laser

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February 13, 2013

Abstract

Atomic clocks based on optical transitions, while the most accurate instruments made to date, can be improved if the frequency of the probing laser is stabilized. The frequency stability of lasers is often smeared by the optical resonator being used to stabilize them. The small atomic vibrations and thermal noise affect the frequency. By removing the optical resonator, Bohnet and colleagues have created a prototype superradiant laser out of rubidium atoms. Instead of having the energy contained within the light field inside the resonator, the energy of the laser is now predominantly stored inside the atoms. This allows the laser to operate even when there is an average of less than one photon in the resonator. By removing the optical resonator from the equation, the laser's frequency is now less perturbed by the atomic vibrations and thermal noise and therefore more stable. Bohnet et al. have characterized the frequency stability of this novel, unusually ultrastable laser, but further tests are needed before these types of lasers can be used to improve accurate timekeeping.

References:

1. Bohnet, J. et al. Nature 484, 78-81 (2012).
2. Vuletic, V. Nature 484, 43-44 (2012)