

Optical Atomic Clock: A long look at the captured atoms

February 5 2008

Optical clocks might become the atomic clocks of the future. Their "pendulum", i.e. the regular oscillation process which each clock needs, is an oscillation in the range of the visible light. As its frequency is higher than that of the microwave oscillations of the cesium atomic clocks, physicists expect another increase in the accuracy, stability and reliability.

In the case of one of the candidates for an optical clock which is developed at Physikalisch-Technische Bundesanstalt (PTB), strontium atoms are retained in the interference pattern of two laser beams.

In this so-called "optical grating" the atomic "pendulum", i.e. the absorption frequency of the atoms, can then be measured very exactly. For this optical grating clock, the loading of cold atoms into an optical grating has been optimized to such an extent that approx. 10⁶ strontium atoms are loaded into the grating within 150 milliseconds at a temperature of a few microkelvin.

There, the atoms remain stored for over one second and are available for a precision measurement of the optical frequency.

This value would serve for the redefinition of the base unit "second" provided that additional investigations and international comparison show that this frequency can be determined with sufficient accuracy.

Source: Physikalisch-Technische Bundesanstalt

Citation: Optical Atomic Clock: A long look at the captured atoms (2008, February 5) retrieved 2 May 2024 from <https://phys.org/news/2008-02-optical-atomic-clock-captured-atoms.html>

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