



Schematic representation of the principle

Advantages

- long-term stability over 24 hours
- sub-Hz linewidth
- use of proven and tested commercial components
- PTB NIM-format electronic plug-in units

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Long-term-stable Single-frequency Laser

Narrow-band lasers with extremely small bandwidths are increasingly being used in spectroscopy, metrology, astrophysics and ultra-precise measurement technologies. In this context, it is not unusual to attain linewidths of ≤ 1 Hz. Until recently, the long-term stability of such systems was not realizable at all or only involving disproportional effort. PTB can now provide a patented technical solution consisting in coupling the system to a highly stable radio source.

Technical description

The idea basically consists in combining the advantages of the stable properties of two frequency sources, for example the short-term stability (= small linewidth) of a highly stable laser with long-term-stable sources which typically emit in the RF range. This can be, for example, a hydrogen maser, a chip-scale caesium atomic clock or simply a GPS-disciplined oscillator.

By judiciously combining the complementary properties of different frequency sources, an optical frequency source can be realized which is characterized by a small linewidth associated with high long-term stability.

Scope of application

Depending on the type of frequency sources used, an *optical* reference frequency can, in principle, be generated and locally disseminated, similar to the 10 MHz, which are standard in laboratories, in the radiofrequency range.

Economic significance

A narrow-band optical frequency source with high long-term stability opens up possibilities of precision measurements over long periods, for example in scientific spectroscopy, astrophysics or analytical laboratories in various economic domains. In addition, it is well suited to calibrate and characterize narrow-band light sources, for instance in photonics.

Development status

The special regulating unit was developed as an NIM plug-in unit for 19" racks and tested at PTB. Finalizing the development can only be achieved by licensees alone or in cooperation with PTB. Patent pending: DE 10 2012 008 456.