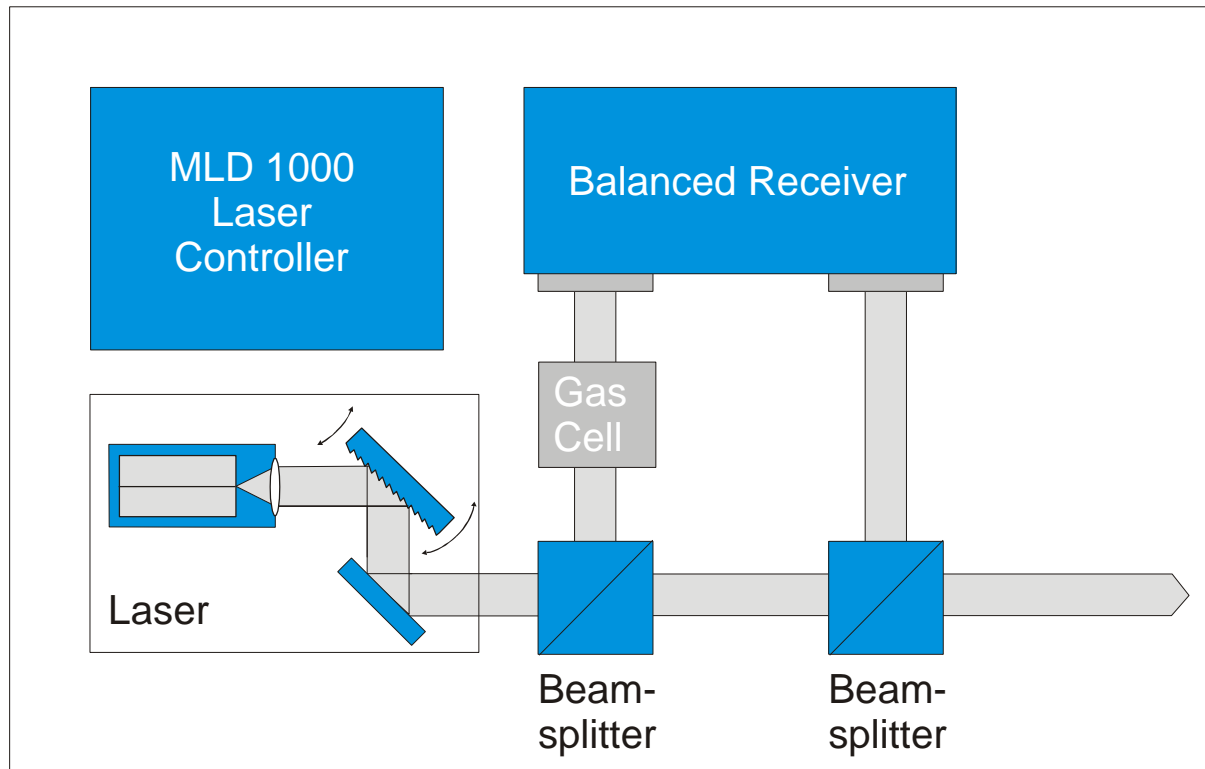


Technical Note – No. 23

Lockbox

Principles of active Stabilization of a Laser with Reference Gas Cell and Balanced Receiver



Description:

The active stabilization plug-in PI-1000-AS for our modular laser driver system MLD1000 provides a locking of our laser systems on an atomic reference. In order to use the active stabilization, the laser beam is split up into a probe beam and a reference beam. The probe beam is sent through an atomic reference cell to a balance receiver. The reference beam is directly coupled to the balanced receiver. The signal of the balanced receiver is fed back to the active stabilization plug-in PI-1000-AS. By this way, the emission wavelength of the laser system will be stabilized to the atomic reference.

Document: <http://data.sacher-laser.com/techdocs/LockBox.pdf>

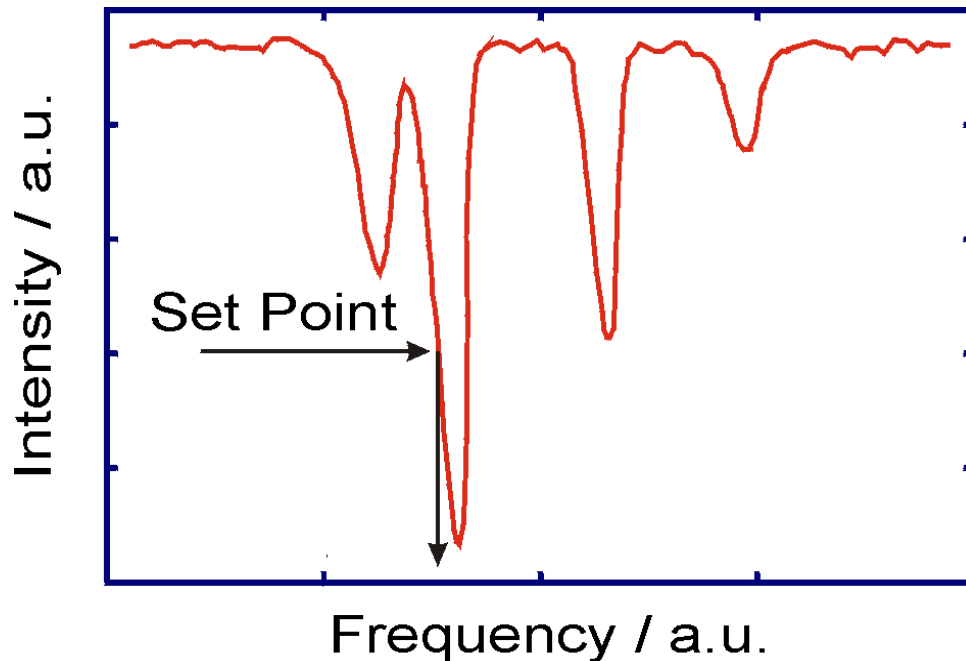
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Physical Basics

A part of the laser light will be coupled through the reference gas cell. The figure shows the absorption profile of the D2 line of Rubidium while the wavelength of the laser is scanned. By this way, the wavelength change is transferred into an intensity change. This is the physics where our active stabilization plug-in is based on.

Operation

The first step of the stabilization process is to select a set point of the power value of the photodiode at the lock-box. The second step is to decrease the amplitude of the internal ramp generator to zero. Then the system is locked to the atomic reference. No more drifts of the emission wavelength of the laser system will occur.

Reference

K. B. MacAdam, A. Steinbach, C. Wieman, A narrow-band tunable diode laser system with grating feedback, and a saturated absorption spectrometer for Cs and Rb, Am. J. Phys. 60 (12) pp.1098-1111, Dec. 1992

Application

This type of Lockbox is most commonly used in experiments which require optical cooling and trapping equipment. It is easier in handling than the Pound-Drever-Hall type of stabilization.

Reference

C. Wieman, Glenn Flowers, Inexpensive laser cooling and trapping experiment for undergraduate laboratories, Am. J. Phys. 63 (4), pp.317-330, April 1995

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