



CoSy

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Compact Spectroscopy unit for absorption saturation spectroscopy

The method of saturation spectroscopy allows to represent a wavelength with extremely high precision, e.g., for absolute stabilization of tunable lasers.

Example



Doppler-free absorption saturation spectrum of the Cs-D₂ line

Principle of Operation

The method of saturation spectroscopy allows to represent a wavelength with extremely high precision, e.g., for absolute stabilization of tunable lasers. Light from a tunable laser is led into a glass cell filled with a suitable gas, the particles of which absorb light of particular wavelengths. By the technique of Doppler-free saturation spectroscopy, a suitable optical setup consisting of several part beams compensates for the Doppler broadening of atomic lines to a large extent, which highly increases the resolution of the measured absorption lines.

Usually this is achieved by using a relatively complex opto-mechanical setup. The truly compact CoSy system contains this setup and also all the evaluation electronics needed to obtain a Doppler-free saturation spectrum as an output voltage directly observable on an oscilloscope.



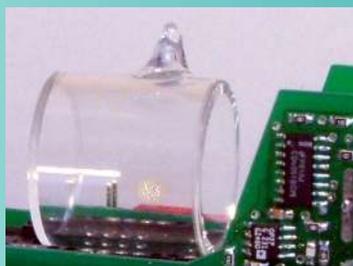
CoSy measurement head and CoSyControl electronics

The laser irradiating the system can thus be stabilized to any of the detected lines. This may be done for example using TEM Messtechnik's *LaseLock* or the modules PID110 or LIR110 by TOPTICA Photonics. In this way a frequency uncertainty below 1 MHz can be achieved, corresponding to a relative uncertainty of 10^{-9} .

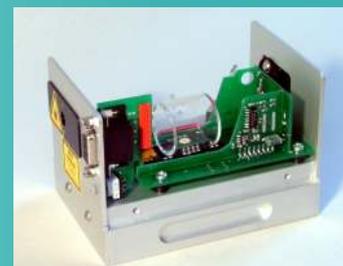
The complete opto-mechanical setup, consisting of beamsplitters, mirrors, detectors, and the spectroscopy glass cell, is integrated in the CoSy measurement head. As the degree of absorption depends on the vapor pressure of the chemical element in the glass cell and therefore on its temperature, the CoSy head is equipped with a regulated cell heating.



CoSy integrated into DL 100



alkali spectroscopy cell

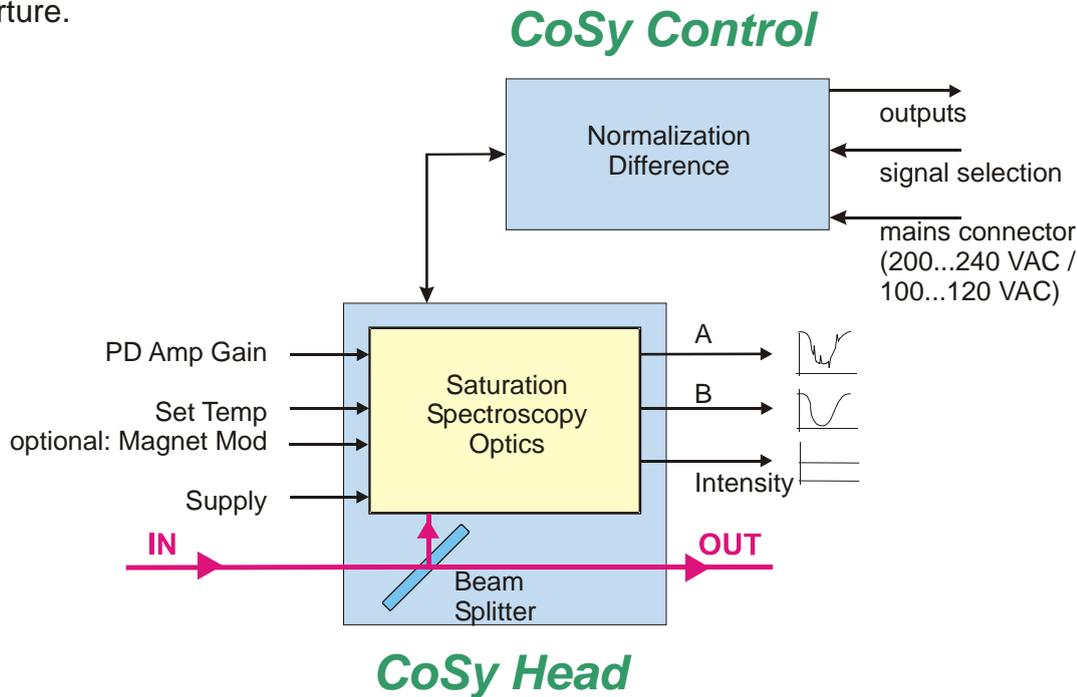


CoSy head from the inside

Block Diagram

CoSy

For operation, a laser beam is directed into the CoSy head. For easy adjustment, an FC single-mode fiber connector can be mounted at the input aperture.



The CoSy head is controlled by the power supply and control electronics *CoSyControl*. This includes the power supply module, the processing unit for generation of normalisation and difference signals, the BNC-connectors for the output signals (A, B and Intensity), as well as the temperature control unit, and optionally the magnetic modulation unit.

CoSyControl generates the doppler free saturation spectrum of the chosen chemical element from the CoSy head signals by amplification and electronic signal processing.

Product Variants

- "FC": For easier adjustment, the CoSy head can be equipped with an FC single-mode fiber connector.
- "FC-APC": As "FC", but for APC- (angle-polished-) fibers.
- "COIL": For some applications the CoSy system provides optionally the possibility to apply a magnetic field (AC or DC) to the cell. This is done by a coil, which is located around the cell.

Technical Data

Dimensions of the glass cells:	25 mm x 25 mm or 25 mm x 15 mm
Glass cell filled with one of the following elements:	Rubidium (mixture of ^{85}Rb and ^{87}Rb) Potassium (mixture of ^{39}K and ^{41}K) Caesium (^{133}Cs) Other cells on request.
Recommended optical input power:	< 1 mW, depends on used element
Size of free beam:	< 3 mm diam.
Polarization of free beam:	perpendicular to table top
Gain of the photo detector amplifiers:	adjustable via range switch (coarse) and trim potentiometer (fine)
Output level:	max. 10 Vpp
Set temperature of the glass cell:	adjustable via trim potentiometer, in the range of 20 to 40 °C (no cooling)
Optional AC or DC magnetic field:	magnetic flux density adjustable, maximum current 0.1 Ampere
Housing dimensions:	
CoSy head:	80 mm x 80 mm x 114 mm
CoSyControl mini:	88 mm x 125 mm x 209 mm (2 height units)
Power supply of CoSyControl:	100...120 VAC / 200...240 VAC, 50...60 Hz

Subject to change without notice

Development, Manufacturing and Distribution



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