

Fourier Transform Spectroscopy (CA-1710)



Fourier transform spectroscopy (FTS) offers an alternative to conventional spectroscopy techniques using dispersive elements. An advantage of FTS are the stronger signals, especially for weak light sources. A disadvantage might be a higher noise sensitivity.

The basic setup of a Fourier transform spectrometer is a Michelson interferometer with a movable mirror. Scanning this mirror generates a temporal interference pattern of the light beams which carries the spectral information of the light source or an absorbing

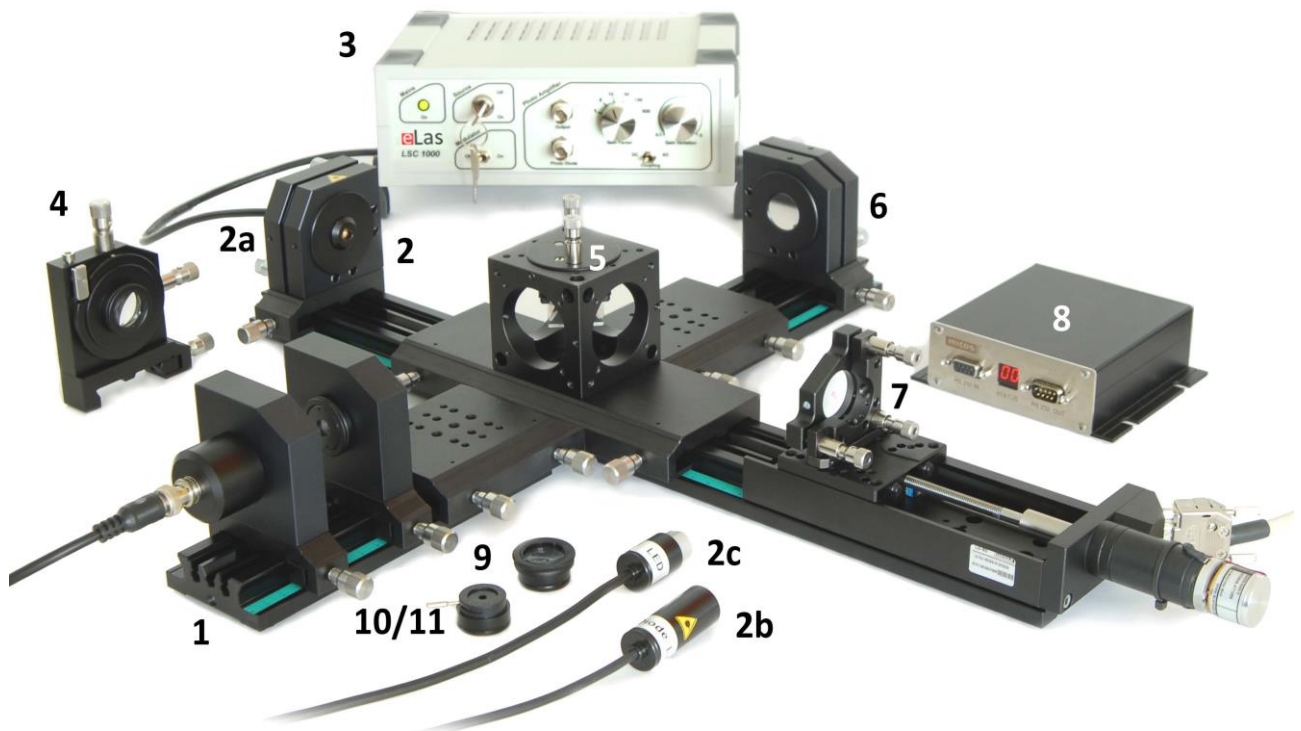
sample placed in the beam path. This interference signal is detected and by subsequent Fourier transformation the spectral profile is extracted.

Three light sources of different spectral properties are provided in this experimental kit. The mirror of the measurement arm is mounted on a high precision translation stage driven by a controller, both from miCos. Different motion sequences within a broad velocity range can be programmed. The interference signals are recorded, evaluated and Fourier transformed in a PC.

Educational Objectives of Investigation

- Interferometer
- Coherence
- Time-bandwidth relation
- Line / band spectrum
- Signal beating
- Fourier transformation
- Apodisation
- Zerofilling

Setup and Components of the kit



- 1 Flat rail 200 mm with scale (3 pieces)
- 2 Adjustment holder for light sources on carrier
- 2a Green DPSS Laser in mount
- 2b Red Laser diode in mount
- 2c High power LED in mount
- 3 Laser and LED Control electronics LSC 1000 with integrated photo diode amplifier and signal conversion card
- 4 Beam collimator in XY adjustment holder on carrier
- 5 Beam splitter in adjustable holder on carrier cross piece
- 6 Plane broadband mirror in adjustment holder on carrier
- 7 Mirror in adjustment holder on motorized translation stage
- 8 Controller for motorized stage with interconnection cables
- 9 Beam expanding optics
- 10 Photodetector in holder with iris diaphragm
- 11 Target screen insert

Ordering Information

For ordering the Fourier Transform Spectroscopy kit (CA-1710)

use ordering number: 490091710

Examples of Measurements

Michelson interferometer based spectrometer

A Michelson interferometer with beamsplitter plate and one of the mirrors mounted on a motorized translation stage is set up. By superimposing the beams of the measurement and reference arms interference stripes are observed. After optimization of the interference pattern the Fourier transform spectrometer is ready for measurements.

Fringe detection

A silicon PIN photo diode detects the interference signal as a function of the delay introduced by the motorized translation stage. Shunted by an appropriate resistor the detector is fast enough to follow the signals even with fast running translation stage. The motion of the stage is programmed and started on a PC.

Variation of Light Source

Three light sources with different spectral widths are provided: a DPSS laser, a red laser diode and an LED. With increasing spectral width the coherence length and hence the range of delay necessary for the measurement is reduced.

Signal displaying

Signals from the photo diode are A/D converted, fed in a PC and displayed on the monitor. An additional oscilloscope is therefore not necessary.

Fourier transformation

In a last step the recorded interferogram is Fourier transformed. By apodisation with different windows (Hanning, Hamming, Blackman etc.) an appropriate spectrum shape can be attained