FT-IR Instrument

Components

- Source
- Michelson Interferometer
- Sample
- Detector

Note

- No dispersion element (monochromator)
- All radiation is analyzed simultaneously, the resulting FID (intensity as a function of time) is FT’d to produce the spectrum (intensity as a function of frequency)

Sources

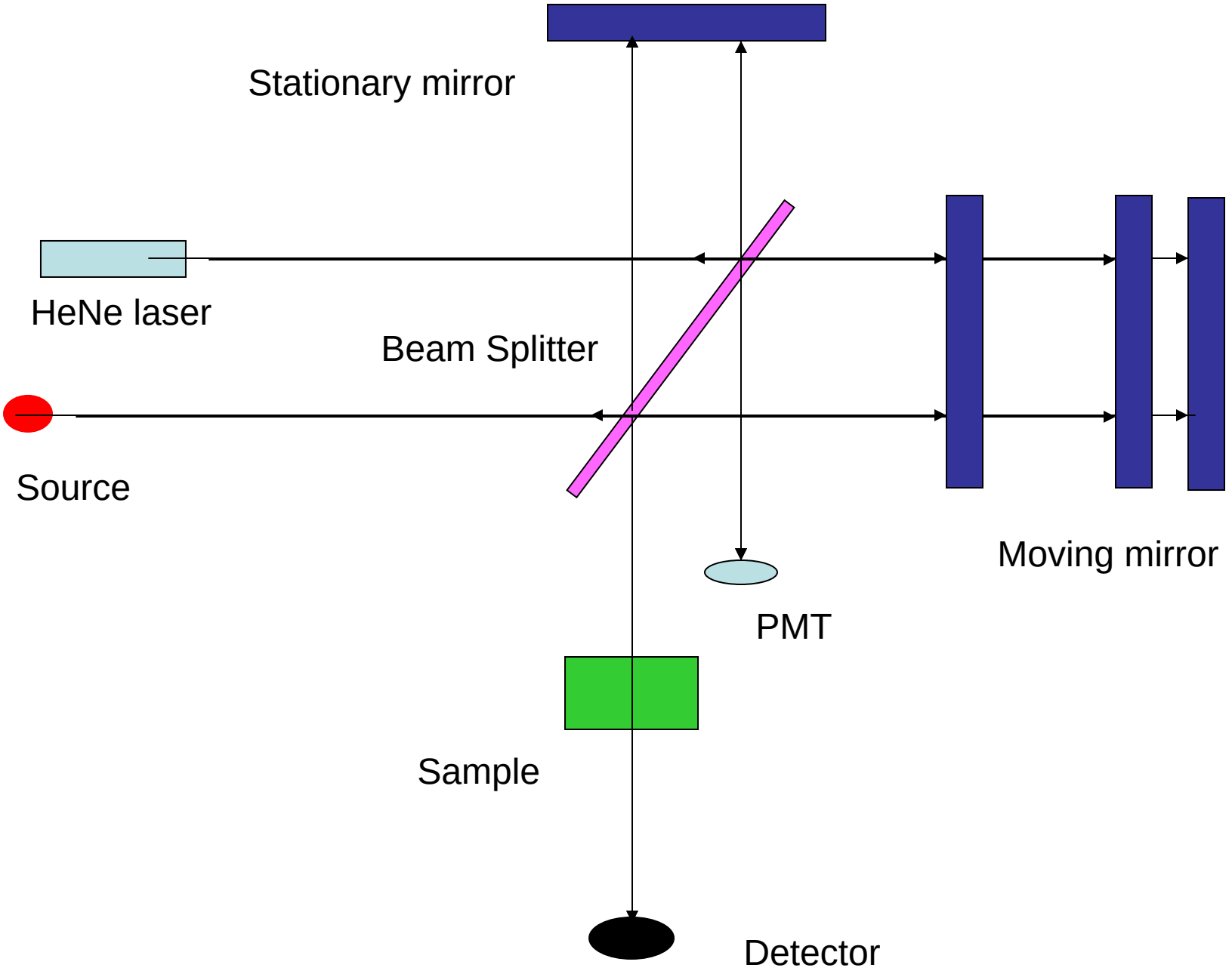
- Black body radiators
- Inert solids resistively heated to 1500-2200 K
- Max radiation between 5000-5900 cm^{-1} (2-1.7 μm), falls off to about 1 % max at 670 cm^{-1} (15 μm)
- Nernst Glower – cylinder made of rear earth elements
- Globar- SiC rod
- CO_2 laser
- Hg arc (Far IR), Tungsten filament (Near IR)

Michaelson Interferometer

- 10^{14} Hz is too fast for P to be directly measured as a function of time
- Can not measure the FID signal directly
- Interferometer creates a replicate interference pattern at a frequency that is a factor of 10^{10} times slower
- 10^{4}-10^{5} Hz can be measured electronically
- $f = (2v_m/c)\nu = 10^{-10}\nu$, v_m = 1.5 cm/s

Michaelson Interferometer

- Beam splitter
- Stationary mirror
- Moving mirror at constant velocity
- Motor driven Micrometer screw
- He/Ne laser; sampling interval, control mirror velocity


Stationary mirror
HeNe laser
Beam Splitter
Source
Moving mirror
PMT
Sample
Detector

Sample

- Sample holder must be transparent to IR- salts
- Liquids
  - Salt Plates
  - Neat, 1 drop
  - Samples dissolved in volatile solvents- 0.1-10%
- Solids
  - KBr pellets
  - Mulling (dispersions)
- Quantitative analysis-sealed cell with NaCl/NaBr/KBr windows

Detector

- Transducers
  - The heating effect of radiation
- Thermal transducer- black body, small, very low heat capacity- $\Delta T=10^{-3}$ K, housed in vacuum, signal is chopped
- Thermocouples
  - Two junctions of dissimilar metals, An and Bi
  - One is IR detector, one is reference detector
  - Potential difference that develops in proportional to ΔT; detection of ΔTs of 10^{-6} K is possible

FT-IR detectors

- Pyroelectric tranducers

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NICODOM IR Libraries, http://www.ir-spectra.com