BHARATHIDASAN UNIVERSITY

Tiruchirappalli – 620024,
Tamil Nadu, India.

Programme: M.Sc., Botany

Course Title : CELL BIOLOGY AND BIOINSTRUMENTATION
Course Code : 22PGBOT104

Unit – IV
BIOINSTRUMENTATION
Topic: FTIR

Dr. M. SATHIYABAMA
PROFESSOR
Department of Botany

FTIR

IR region

- Lies between visible and microwave portions of the electromagnetic spectrum.
- IR waves have wavelengths longer than visible and shorter than microwaves
- Three region: near, mid and far infra red
- Near IR – closest to visible light
- Far IR – closer to microwave region
- Mid IR – region between these two

FTIR

- Fourier-transform infrared spectroscopy is a vibrational spectroscopic technique, meaning it takes advantage of asymmetric molecular stretching, vibration, and rotation of chemical bonds as they are exposed to designated wavelengths of light.
- Fourier transform is to transform the signal from the time domain to its representation in the frequency domain

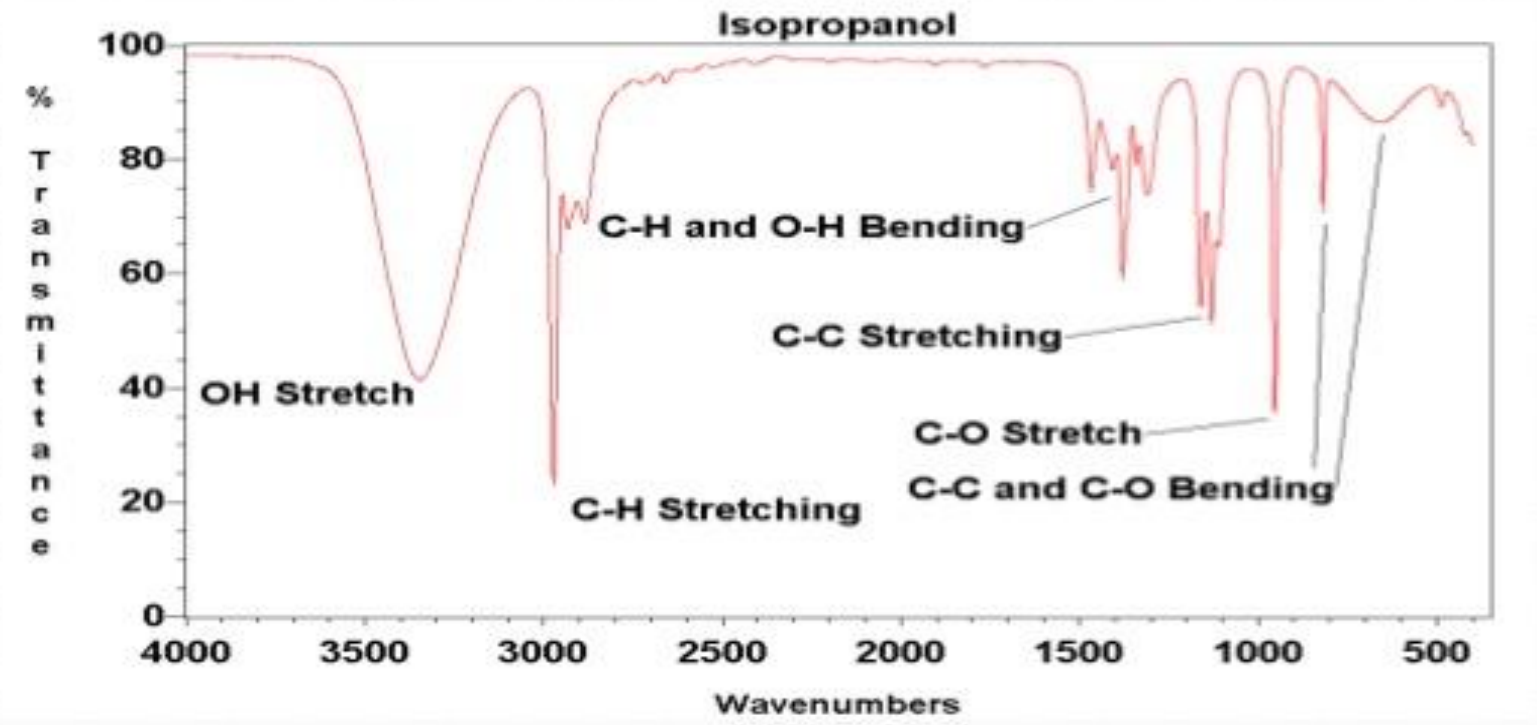
- Absorption peaks in an infrared absorption spectrum arise from molecular vibrations
- Absorbed energy causes molecular motions which create a net change in the dipole moment.

- Provides information about the vibrations of functional groups in a molecule
- Every bond or functional group requires different frequency for absorption. Hence characteristic peak is observed for every functional group.
- **Therefore, the functional groups present in a molecule can be deduced from an IR spectrum**

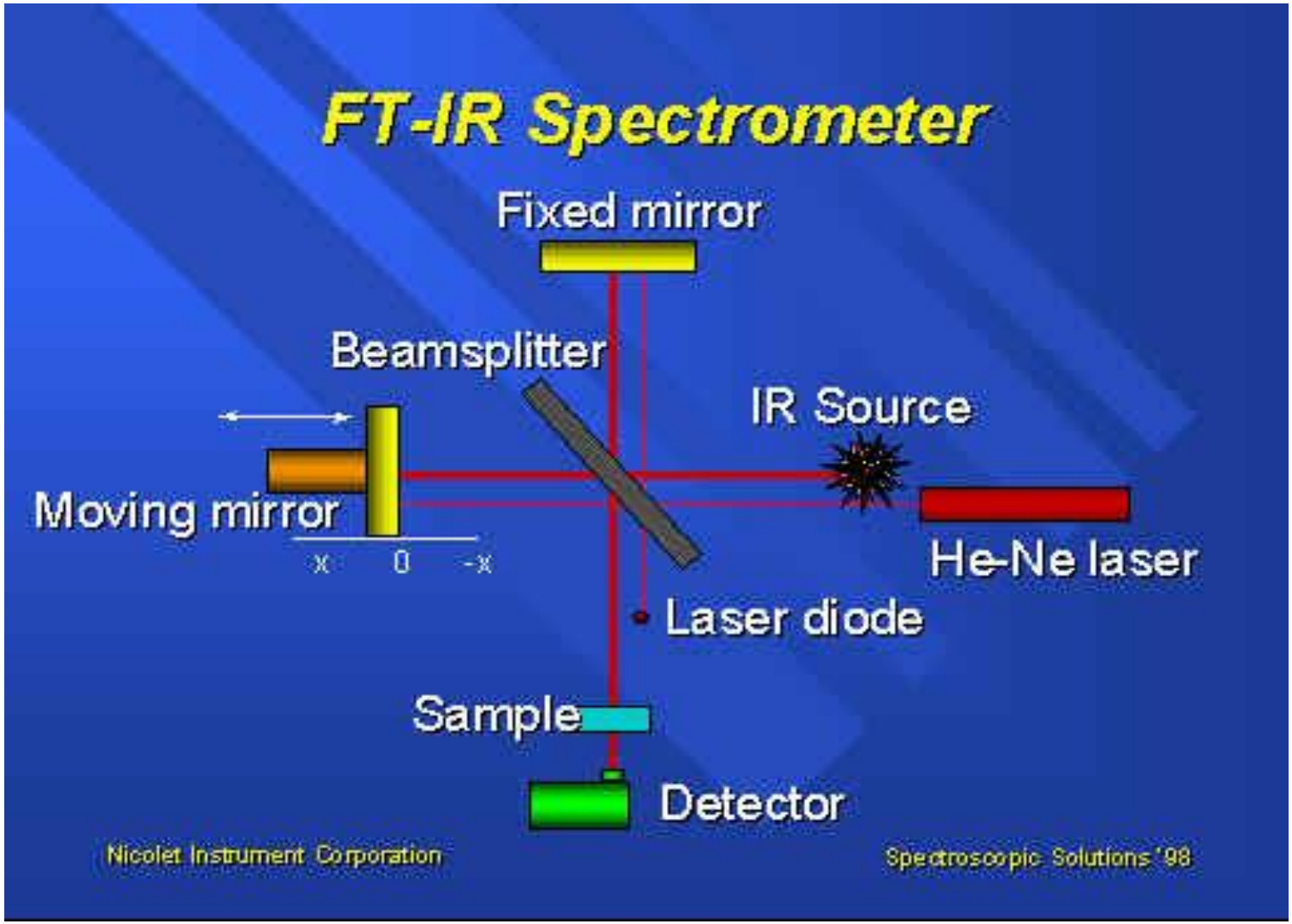
- IR deals with the interaction of infrared radiation with matter. The IR spectrum of a compound can provide important information about its chemical nature and molecular structure.
- Most commonly, the spectrum is obtained by measuring the ***absorption*** of IR radiation, although infrared emission and reflection are also used.
- Widely applied in the analysis of organic materials, also useful for polyatomic inorganic molecules and for organometallic compounds.

Infrared Spectroscopy

For isopropyl alcohol, $CH(CH_3)_2OH$, the infrared absorption bands identify the various functional groups of the molecule



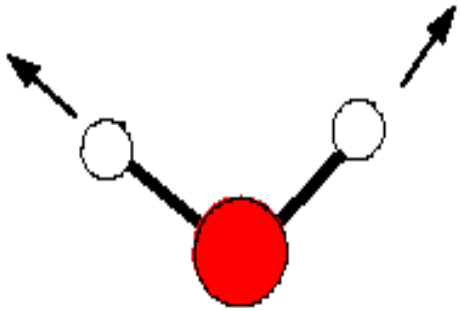
Instrumentation



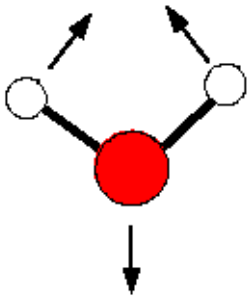
- Light enters the spectrometer and is split by the beam splitter.
- The light originates from the He-Ne laser
- Half of the light is reflected 90 degrees and hits a fixed mirror, while the other half passes through the beam splitter and hits the moving mirror
- The split beams are recombined, but having traveled different distances, they exhibit an interference pattern with each other
- As they pass through the sample, the detector collects the interfering signals and returns a plot of response v. mirror displacement known as an interferogram

- There are two different types of vibrational modes:

- Vibrations can either involve a change in bond length (stretching) or bond angle (bending)



Stretching



Bending

- Identify unknown matrials.
- Quality of the sample.
- Components in micture.

Applications

- Compositional analysis of organic, inorganic and polymers
- Biological and biomedical fields like detection of water in biological membranes
- Analysis of Aircraft exhausts
- Measurement of toxic gas in fuels
- Combustion
- Gas analysis
- and lots more

- Thank You