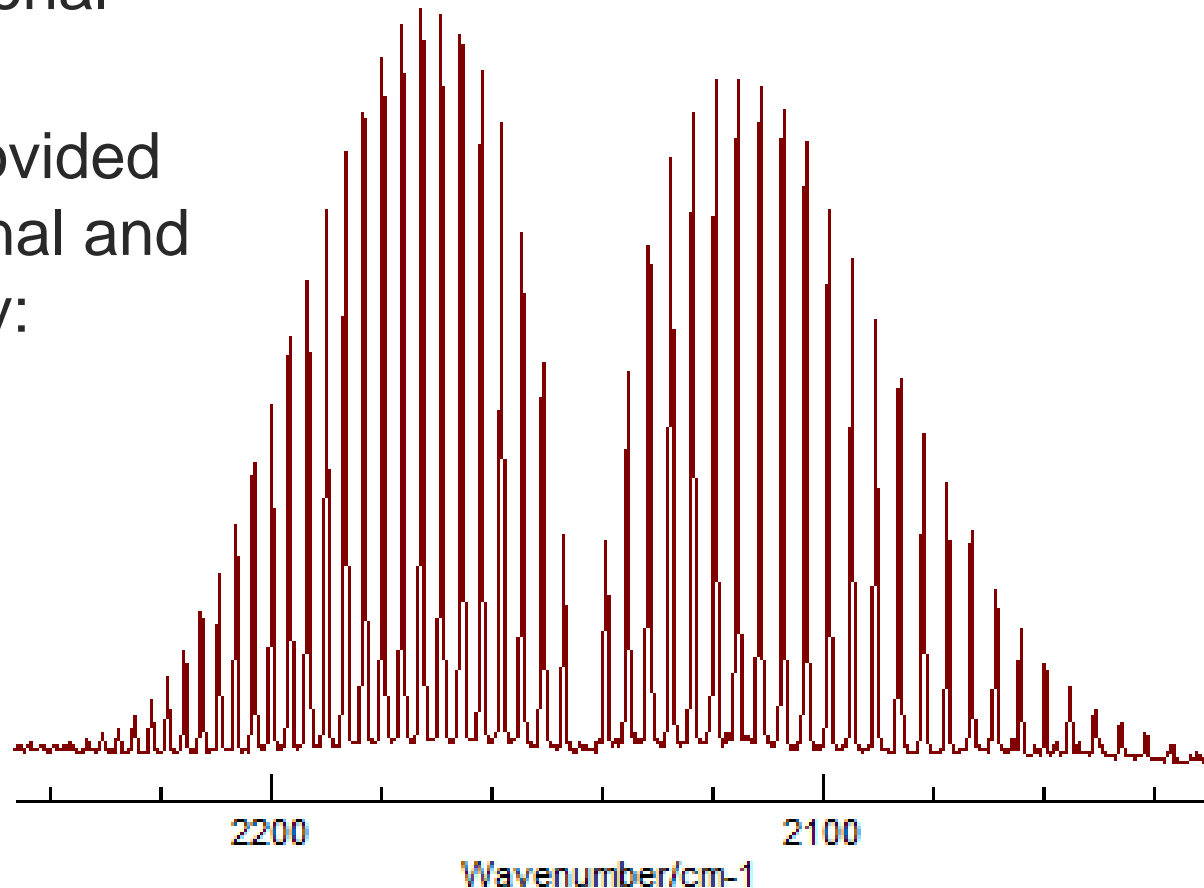


Rotational-vibrational
spectroscopy:

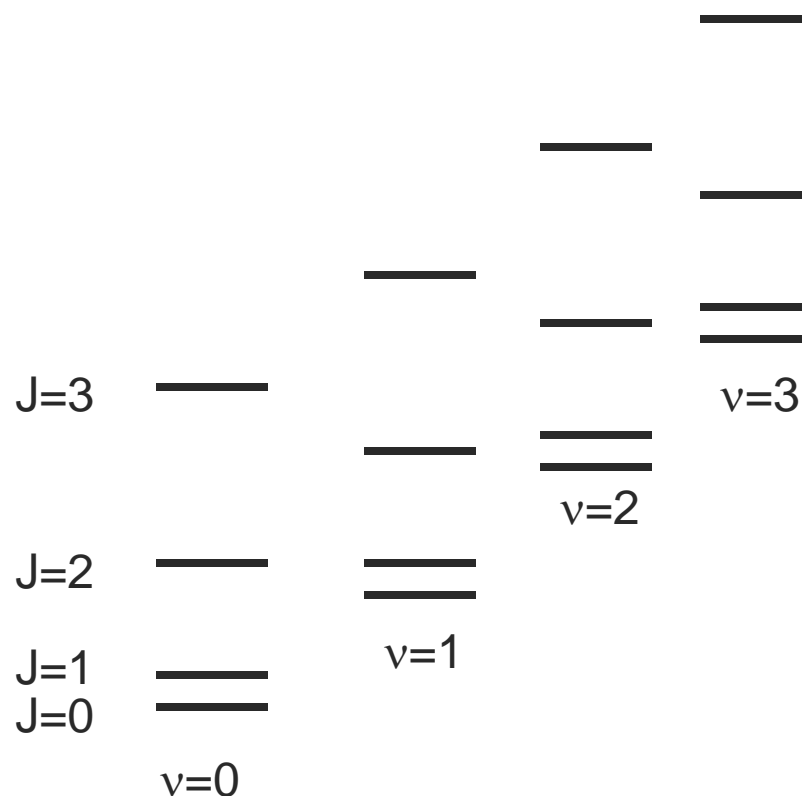
Rotation and Vibration

- Rotational-vibrational spectroscopy
- Energy states provided by sum of rotational and vibrational energy:
- CO spectrum
- Selection rules



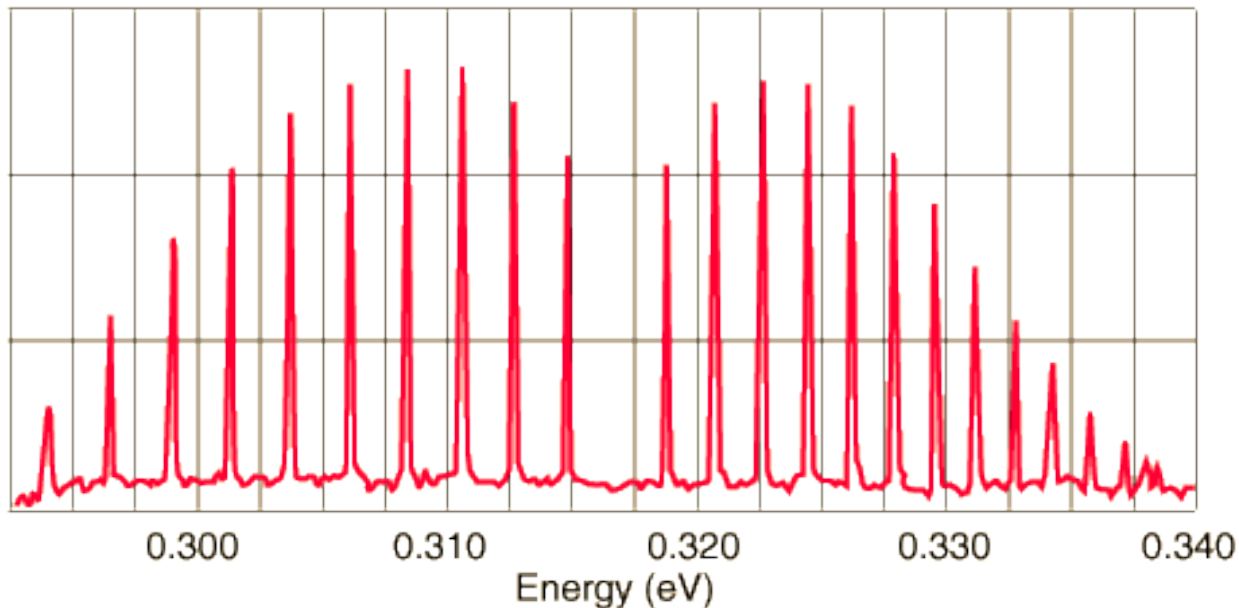
[Rotation and Vibration]

- Rotational-vibrational spectroscopy
- Energy states provided by sum of rotational and vibrational energy:



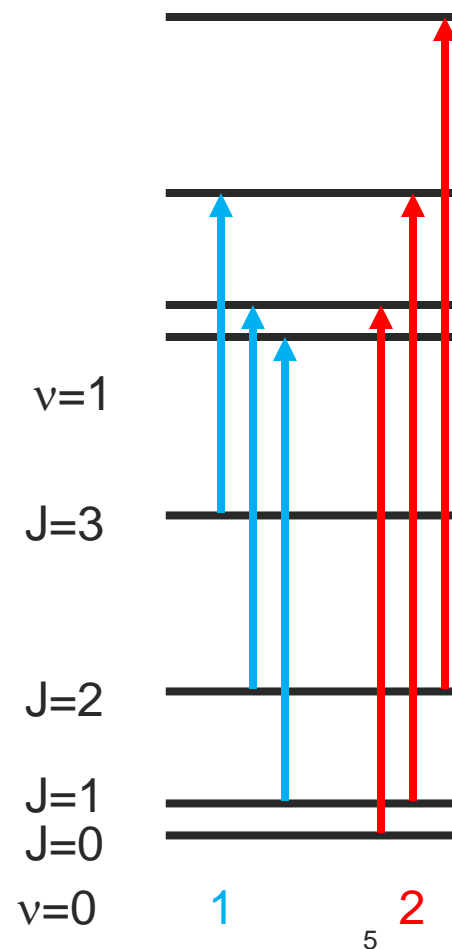
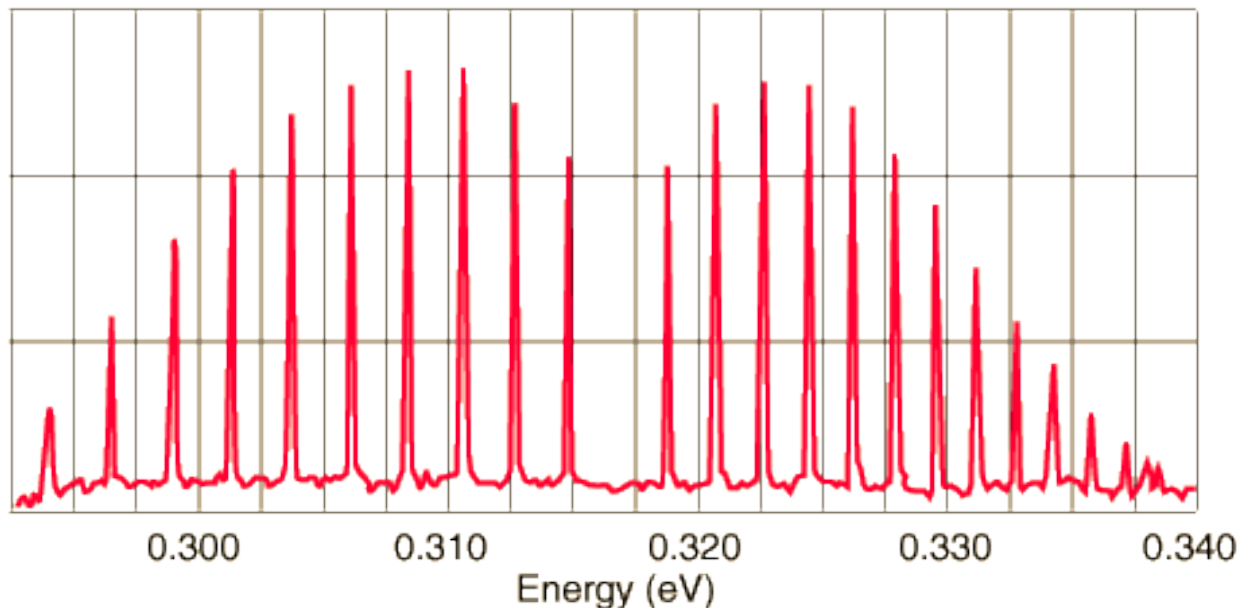
[Rotation and Vibration]

- Simple equation suggests equal spacing on either side of $\tilde{\nu} = 0$.
- Spacing is clearly not equal



[Iclicker: Rotation and Vibration]

- Which class of transitions is responsible for the series of lines above 0.3175 eV?
 - A – 1 B – 2 C – neither D – both



[Rotation and Vibration]

- Spacing is clearly not equal (1)

[Rotation and Vibration]

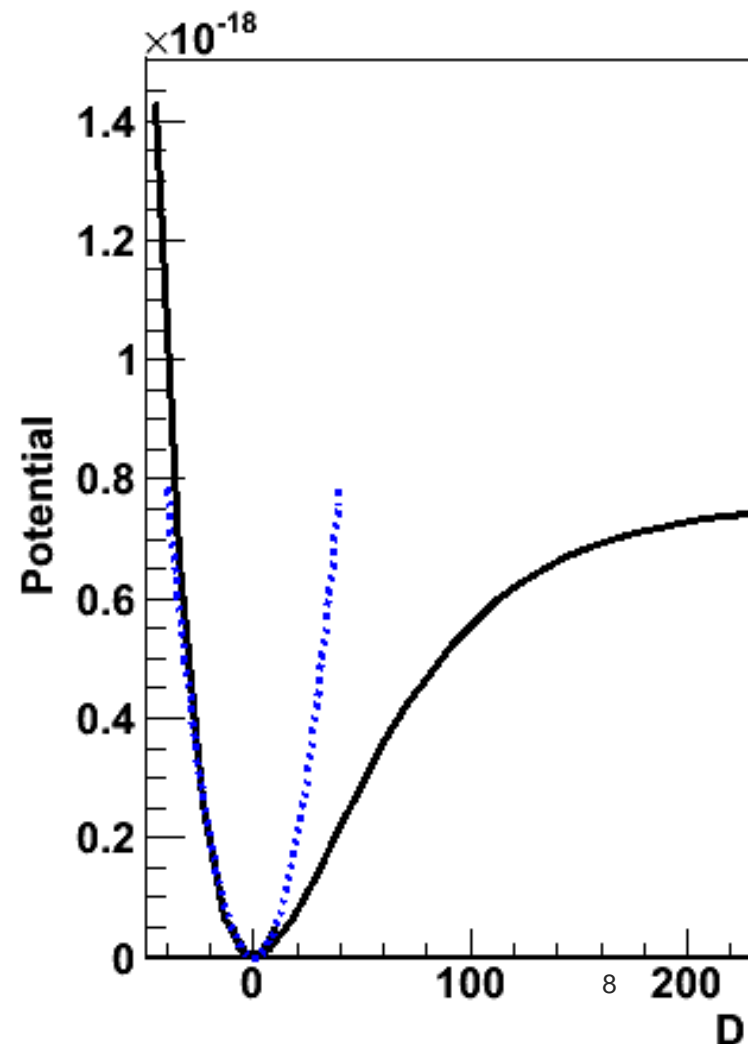
- Spacing is clearly not equal (2)

[Anharmonicity and Overtones

1

- Harmonic oscillator is only an approximation
- Excitations not allowed under approximation.

■ $^1\text{H}^{35}\text{Cl}$



[Anharmonicity and Overtones]

- Correct harmonic oscillator by retaining higher-order terms in potential.
- x_e is anharmonicity constant.
- Divide by hc to get wavenumber
- Fundamental and overtone found at:

[Iclicker: Intensities]

- What is the origin of the intensity variation in the P branch?
 - A – varying equilibrium bond distances
 - B – breakdown of rotational selection rule
 - C – breakdown of vibrational selection rule
 - D – unequal thermal populations
 - E – the photon detection efficiency varies as a function of energy