Raman Spectroscopy

Tuesday, March 29, 2016 11:54 AM

E brick wilson molecular vibration
VIII A brief Look at Raman
-previously: single photon absorbed or emitted
-Raman: 2 photons are involved
-irradiate and measure another
A type of light scattering

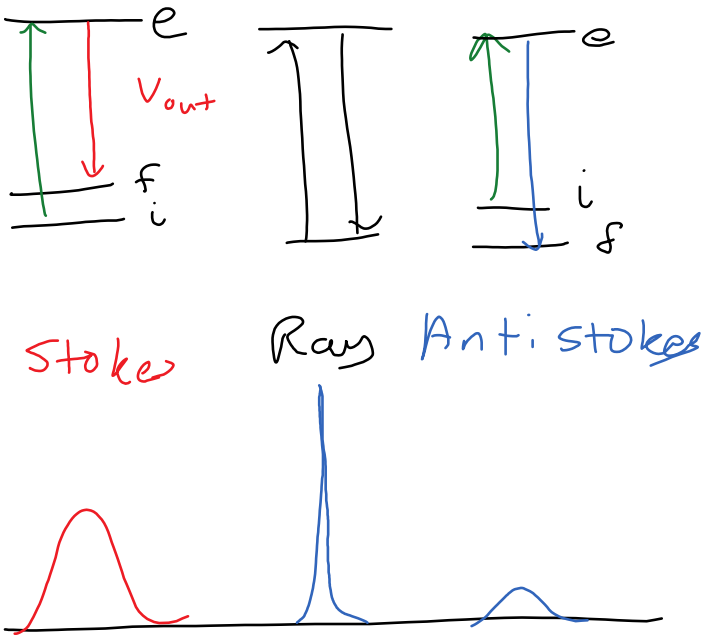
1. Rayleigh Scattering
    a. Elastic scattering
    b. E_{photon}, λ *remains the same*
    c. Direction can change
        i. Scattering distribution depends on λ
2. Raman Scattering
    a. The scattered photon has a different energy then incident
    b. $hv_{intial} = hv_{scattered} \pm hv_{molecule}$
        i. Rovibratioan energy of a molecule

If the scattered photon has lost energy, then it is (red shifted), this is a stokes shifted
If the photon has gained energy, then it is (blue shifted), then it is anti stokes

The blue shift requires the molecule to be in a higher excited state

The Raman Shift
$\Delta v = |v - v_{inc}|$

3. Scattering Process



But intensity of Raman Scattering light depends on the λ_{inc}

- Enabled by tunable lasers

4. Dielectric Polarizability
    - Necessary for RS

- $\vec{E}$ field induces a $\vec{\mu}$
  - $\mu_j = \Sigma_i \alpha_{ji} E_i$

α *is a* 2*nd rank tensor*

α_{ij} *has a principal axis system*

- Here α_{ij} 3×3 *matrix*
- Rovibrational Raman
  - $\left(\frac{\partial \alpha_{ij}}{\partial Q_i}\right)_0 \neq 0$
  - Raman Active