So μ : = $E_0 \sin 2\pi\nu t \cdot \alpha_0 + E_0 \beta \frac{1}{2} \cos 2\pi t(\nu - \nu_0)$
$- E_0 \beta \frac{1}{2} \cos 2\pi t(\nu + \nu_0)$

$E_0 \sin 2\pi \nu t \cdot \alpha_0$ => Rayleigh ~~scattering~~ lines.

$E_0 \beta \frac{1}{2} \cos 2\pi t(\nu - \nu_0)$ => Stokes lines

$E_0 \beta \frac{1}{2} \cos 2\pi t(\nu + \nu_0)$ => antistokes lines.

Quantum mechanical theory of Raman effect

- * A quantum of radiation $h\nu_{ex}$ of incident radiation collide with the molecule. If it is scattered without any energy loss, the scattered light will have the same frequency as the incident light. The phenomenon is called Rayleigh scattering.

- * If the incident light transfer its energy to the vibrational or rotational state in the form of quanta $h\nu_m$. The scattered light will have the slightly lower frequency than the incident light.

$$\boxed{\nu_{sc} = \nu_{in} - \nu_m}$$

These are referred to as Stokes lines

where ν_{sc} = scattered frequency

ν_{in} = Incident frequency

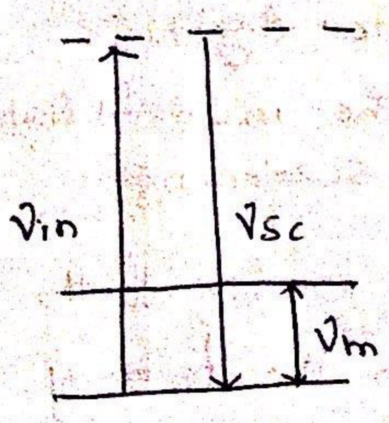
ν_m = Frequency equivalent to energy difference b/w two vibrational or rotational states of the molecule

* The incident light when goes to the excited state, It takes the energy of excited state and hence the scattered light has greater frequ than the incident light. If ν_{in} (incident frequen q light & scattered frequency (ν_{sc}) q light then

$$\boxed{\nu_{sc} = \nu_{in} + \nu_m}$$

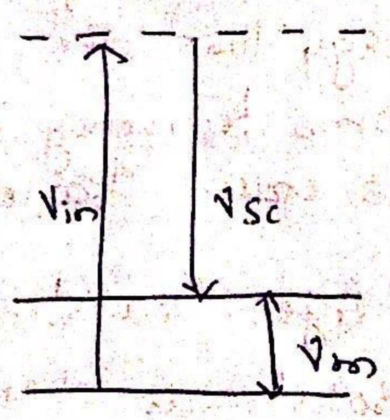
These are referred to as antistokes lines.

Both stokes & antistokes lines are known as Raman Scattering.



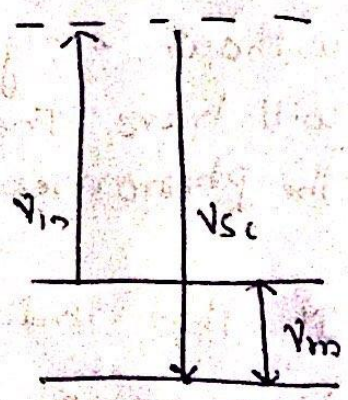
$\Delta\nu = 0$

Rayleigh scattering



$\Delta\nu < 0$

Stokes lines



$\Delta\nu > 0$

Antistokes lines

Raman Scattering.