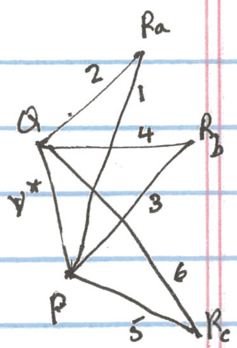
Raman amplitude $\quad \vec{m}_{P\to Q} \propto \sum_R \left(\frac{\langle Q|\vec{x}|R\rangle\langle R|\vec{\varepsilon}\cdot\vec{x}|P\rangle}{E_P - E_R + h\nu} + \frac{\langle Q|\vec{\varepsilon}\cdot\vec{x}|R\rangle\langle R|\vec{x}|P\rangle}{E_P - E_R - h\nu'} \right)$

$(= E_Q - E_R - h\nu)$

case (a) $\quad E_R > E_Q > E_P \quad$ (R_a in Fig. 4 KH)

$\vec{a}_1 \equiv \langle P|\vec{x}|R\rangle, \quad \vec{a}_2 = \langle Q|\vec{x}|R\rangle, \quad E_P - E_R = -h\nu_1$

$E_Q - E_R = -h\nu_2$



$$\vec{m} \propto \frac{1}{h}\sum_{R_a}\left(\frac{\vec{a}_2\, \vec{\varepsilon}\cdot\vec{a}_1^{\,*}}{\nu - \nu_1} + \frac{\vec{a}_1^{\,*}\, \vec{\varepsilon}\cdot\vec{a}_2}{-\nu_2 - \nu} \right)$$

$$= -\frac{1}{h}\sum_{R_a}\left(\frac{\vec{a}_2\, \vec{\varepsilon}\cdot\vec{a}_1^{\,*}}{\nu_1 - \nu} + \frac{\vec{a}_1^{\,*}\, \vec{\varepsilon}\cdot\vec{a}_2}{\nu_2 + \nu} \right)$$

case (b) $\quad E_Q > E_R > E_P$

$E_P - E_R = -h\nu_3, \quad E_Q - E_R = h\nu_4$

$\vec{a}_3 = \langle P|\vec{x}|R\rangle, \quad \vec{a}_4 = \langle R|\vec{x}|Q\rangle$

$$\vec{m} \propto \frac{1}{h}\sum_{R_b}\left(\frac{\vec{a}_4^{\,*}(\vec{\varepsilon}\cdot\vec{a}_3^{\,*})}{-\nu_3 + \nu} + \frac{\vec{a}_3^{\,*}(\vec{\varepsilon}\cdot\vec{a}_4^{\,*})}{\nu_4 - \nu} \right)$$

$$= -\frac{1}{h}\sum_{R_b}\left(\frac{\vec{a}_4^{\,*}(\vec{\varepsilon}\cdot\vec{a}_3^{\,*})}{\nu_3 - \nu} - \frac{\vec{a}_3^{\,*}(\vec{\varepsilon}\cdot\vec{a}_4^{\,*})}{\nu_4 - \nu} \right)$$

KH (40)

case (c) $\quad E_Q > E_P > E_R$

$E_P - E_R = h\nu_5, \quad E_Q - E_R = h\nu_6$

$\vec{a}_5 = \langle R|\vec{x}|P\rangle, \quad \vec{a}_6 = \langle R|\vec{x}|Q\rangle$

$$\vec{m} \propto \frac{1}{h}\sum_{R_c}\left(\frac{\vec{a}_6^{\,*}\, \vec{\varepsilon}\cdot\vec{a}_5}{\nu_5 + \nu} + \frac{\vec{a}_5\, \vec{\varepsilon}\cdot\vec{a}_6^{\,*}}{\nu_6 - \nu} \right)$$

$$= -\frac{1}{h}\sum_{R_c}\left(-\frac{\vec{a}_6^{\,*}\, \vec{\varepsilon}\cdot\vec{a}_5}{\nu_5 + \nu} - \frac{\vec{a}_5\, \vec{\varepsilon}\cdot\vec{a}_6^{\,*}}{\nu_6 - \nu} \right)$$