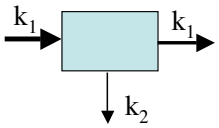
Non-linear Processes

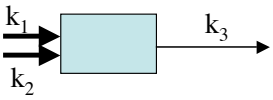
$$\vec{P} = \varepsilon_0 \chi^{(1)} \vec{E} + \varepsilon_0 \chi^{(2)} \vec{E}\vec{E} + \varepsilon_0 \chi^{(3)} \vec{E}\vec{E}\vec{E} + \ldots$$

Intense beams induced higher order interactions in anisotropic materials. SHG requires crystals such as KH_2PO_4 (KDP), $NH_4H_2PO_4$ (ADP), BBO

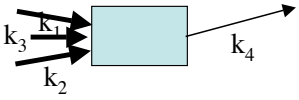
1st order (linear) spectroscopy:
1 hν + material



2nd order spectroscopy:
2 hν + material



3nd order spectroscopy:
3 hν + material



Non-linear Spectroscopy

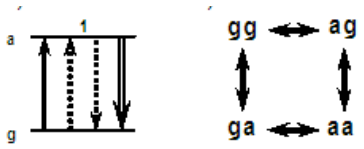
Phenomenological Description -

$$\vec{P} = \varepsilon_0 \chi^{(1)} \vec{E} + \varepsilon_0 \chi^{(2)} \vec{E}\vec{E} + \varepsilon_0 \chi^{(3)} \vec{E}\vec{E}\vec{E} + \ldots$$

Non-linear Spectroscopy

Two Wave Mixing Processes (1excitation+1 material fields)

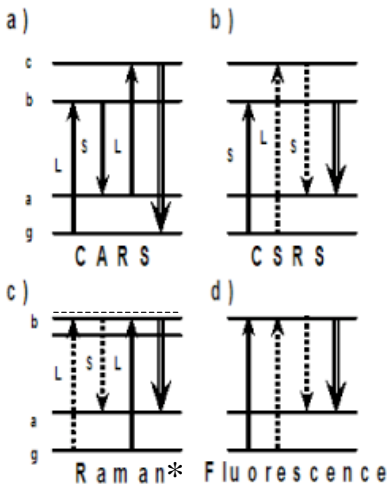
Starting with the most familiar: linear spectrosc.
Rabi cycle: gg→ag→aa→ga→g (w/o dephasing).



http://www.chem.wisc.edu/~wright/NLS.html

Non-linear Spectroscopy

Four Wave Mixing Processes (3 excitation+material fields)



http://www.chem.wisc.edu/~wright/NLS.html

Paper 4: Vibrational Spec.

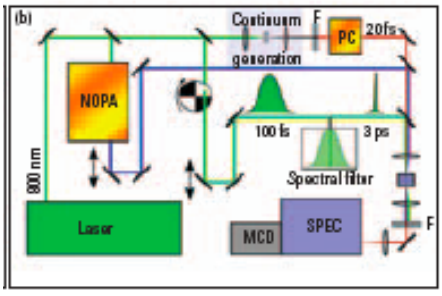
Kukura, P.; Yoon, S.; Mathies, R.A. Femtosecond stimulated Raman spectroscopy, Anal. Chem. 2006, 78 (17), 5952-5959.

Objectives

Approach

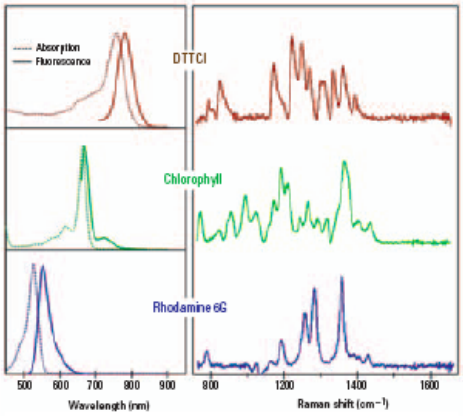
Instrumentation

Fig. 2



Results

Fig. 3



Results

Fig. 5

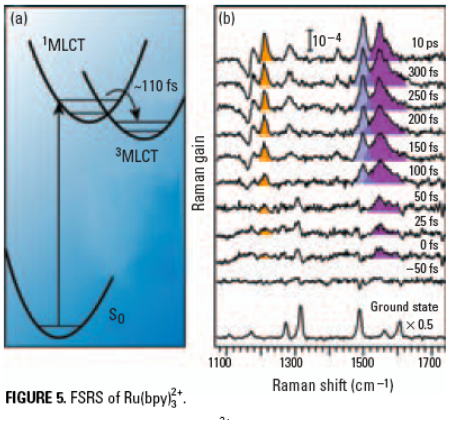


FIGURE 5. FSRS of $Ru(bpy)_3^{2+}$.

Results

Fig. 6

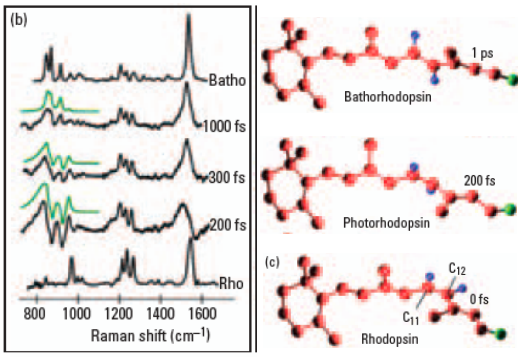


FIGURE 6. The vision thing.

Conclusions

Authors Conclusions

Critique