TEAM

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MAXWELL DESCRIPTION OF X-RAYS DIFFRACTION IN PRESENCE OF OPTICAL EXCITATION

$$div\mathbf{E} = \mathbf{0}, \;\; div\mathbf{H} = \mathbf{0}, \;\; rot\mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}, \;\; rot\mathbf{H} = \frac{4\pi}{c}\mathbf{J} + \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t}$$

$$\rho(\mathbf{r}, t) = 0, \quad \mathbf{J}(\mathbf{r}, t) = \frac{ie^2}{m\omega}\, n(\mathbf{r}, t)\mathbf{E}(\mathbf{r}, t)$$

$$S = \int_{-\infty}^{+\infty} \frac{dI_S}{d\Omega}\, dt = \left(\frac{e^2}{mc^2}\right)^2 P \int_{-\infty}^{+\infty} I_X(t)\;\, f(t)f^*(t)\;\, dt$$

$$f(t) = \int n(\mathbf{r}, t)e^{-i\mathbf{q}.\mathbf{r}}\; d\mathbf{r}$$

STATISTICAL DETERMINATION OF THE SCATTERING FACTOR

$$S = \left(\frac{e^2}{mc^2}\right)^2 P \int_{-\infty}^{+\infty} I_X(t)\ \langle f(t+\tau) f^*(t+\tau)\rangle\ dt$$

$$H = H_0 - \mathbf{M}.\mathbf{E}$$

$$\frac{\partial \rho}{\partial t} = -\frac{i}{\hbar}[H, \rho]$$

$$\langle f(t+\tau) f^*(t+\tau)\rangle = Tr[f(t+\tau) f^*(t+\tau)\rho]$$

STATISTICAL EXPRESSION FOR THE TIME RESOLVED X-RAY SIGNAL

$$\Delta S(\mathbf{q},\tau) = S(\mathbf{q},\tau) - S_0(\mathbf{q})$$

$$\Delta S(\mathbf{q},\tau) = \int_{-\infty}^{+\infty} I_X(t-\tau)\Delta S_{inst}(\mathbf{q},t)\ dt$$

$$\Delta S_{inst}(\mathbf{q},t) = -\left(\frac{e^2}{mc^2\hbar}\right)^2 P$$

$$\times \int_0^{+\infty}\int_0^{+\infty} \Big\langle E_i(\mathbf{r},t-\tau_1)E_j(\mathbf{r},t-\tau_1-\tau_2)\Big\rangle_O$$

$$\times \left\langle \left[\left[\sum_{m,n} e^{-i\mathbf{q}.\mathbf{r}} mn^{(\tau_1+\tau_2)}, M_i(\tau_2)\right], M_j(0)\right]\right\rangle_S \quad d\tau_1 d\tau_2$$

RECOMBINATION OF DISSOLVED IODINE ATOMS

Solvents :

I_2/CCl_4 and I_2/CH_2Cl_2

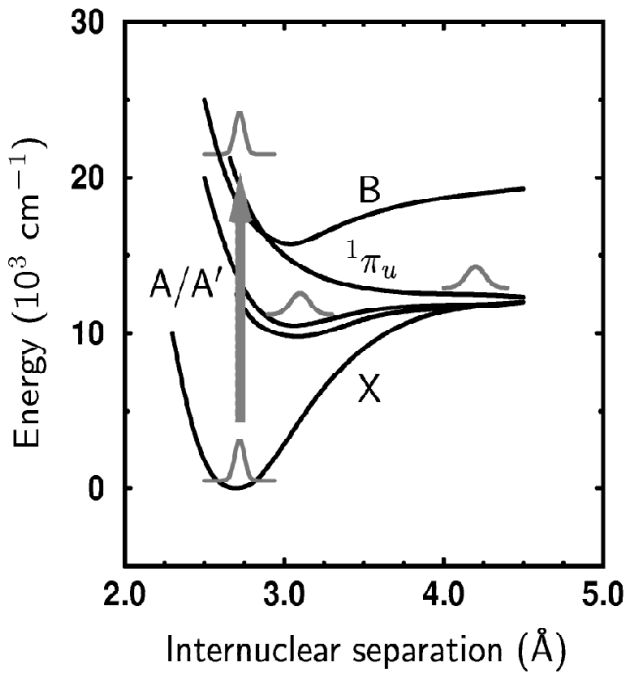
Characteristic times :

τ_X, τ_o, τ_R and $\tau_I = 1/\omega$

Reaction :

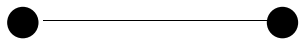
$I_2^* \rightarrow I + I \quad (\alpha)$

$I_2^* \rightarrow I_2 \quad (\beta, \gamma)$



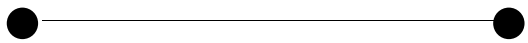
I_2

$\leftarrow$ 2.67Å $\rightarrow$



I_2^*

$\longleftarrow$ 4.00Å $\longrightarrow$



LONG TIME LIMIT OF THE TIME RESOLVED X-RAY SIGNAL

$$\Delta S(\mathbf{q},\tau) = \int_{-\infty}^{+\infty} I_X(t-\tau)\Delta S_{inst}(\mathbf{q},t)\ dt$$

$$\Delta S_{inst}(\mathbf{q},t) = \left(\frac{e^2}{mc^2}\right)^2 f_I^2 P$$

$$\times \sum_j \left[n_j(t) \sum_{\mu,\nu} \left(\left\langle e^{-i\mathbf{q}.\mathbf{r}_{\mu\nu}(t)} \right\rangle_j - \left\langle e^{-i\mathbf{q}.\mathbf{r}_{\mu\nu}(t)} \right\rangle_0 \right) \right]$$

$$n_j(t) = 2Re\left[\frac{1}{\hbar^2} \int_0^{+\infty} \int_0^{+\infty} \left\langle E(\mathbf{r},t-\tau_1)E(\mathbf{r},t-\tau_1-\tau_2) \right\rangle_O \right.$$

$$\left. \times \left\langle M_{oj}(\tau_2)M_{jo}(0) \right\rangle_S\ d\tau_1 d\tau_2 \right]$$

X-RAY MANIFESTATION OF THE IODINE RECOMBINATION

$$\Delta S(\mathbf{q},\tau) = \int_{-\infty}^{+\infty} I_X(t-\tau)\Delta S_{inst}(\mathbf{q},t)\ dt$$

$$\Delta S_{inst}(\mathbf{q},t) = \ 2\left(\frac{e^2}{mc^2}\right)^2 f_I^2 P$$

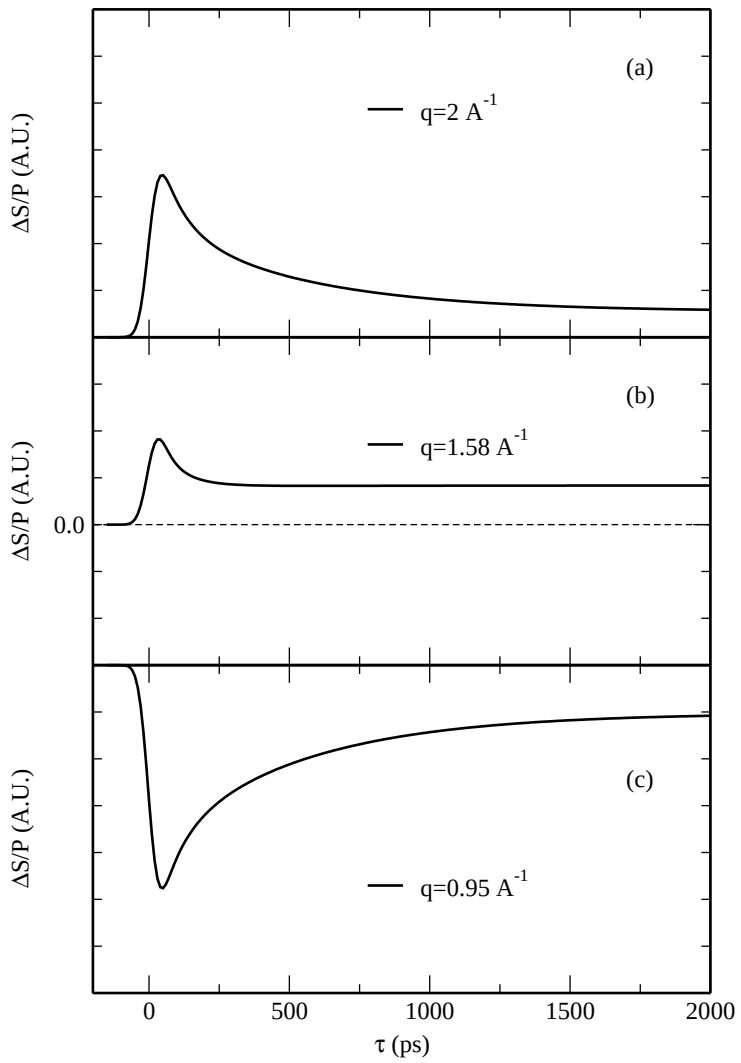
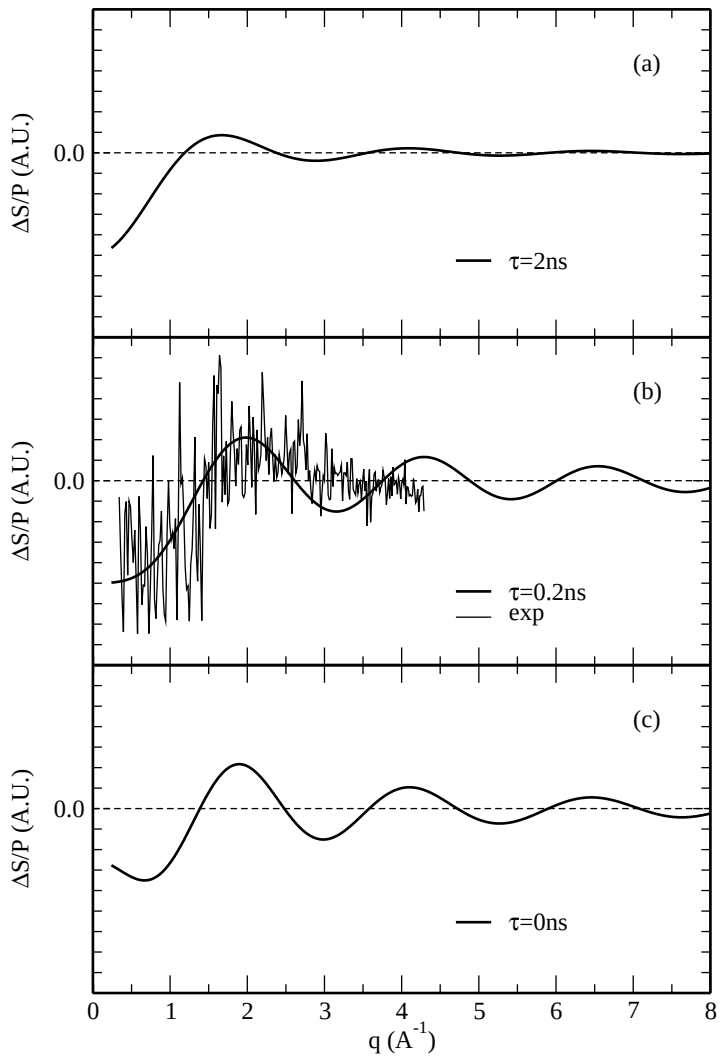
$$\times\left\{ -\xi_E(\tau)\frac{\sin(qR_X)}{qR_X} + \xi_{A/A'}(\tau)\frac{sin(qR_{A/A'})}{qR_{A/A'}} \right.$$

$$\left. +\ \xi_X\left[\int_0^{+\infty} 4\pi r^2 \rho_X(r,t)\frac{sin(qr)}{qr}\ dr\right]\right\}$$

$$\xi_E(t) = n_\alpha e^{-\frac{t}{\tau n}} + n_\beta e^{-\frac{t}{\tau_{isc}}} + n_\gamma$$

$$\xi_{A/A'}(t) = n_\beta e^{\frac{t}{\tau_{isc}}}$$

TIME RESOLVED DIFFRACTION SIGNAL $\Delta S(\mathbf{q}, \tau)$ OF THE MIXTURE I_2/CH_2Cl_2



Q-RESOLVED DIFFRACTION SIGNAL $\Delta S(\mathbf{q}, \tau)$ OF THE MIXTURE I_2/CH_2Cl_2