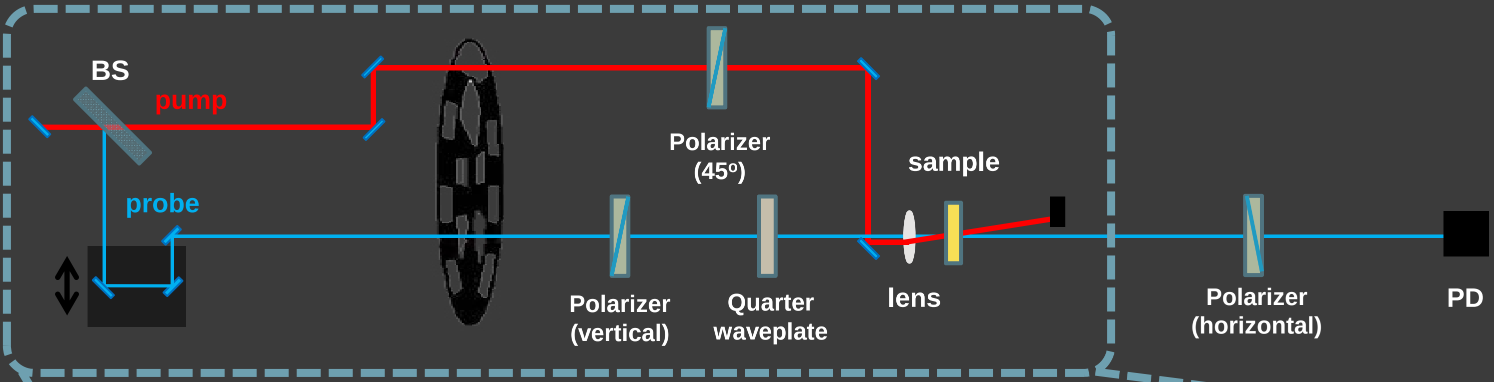
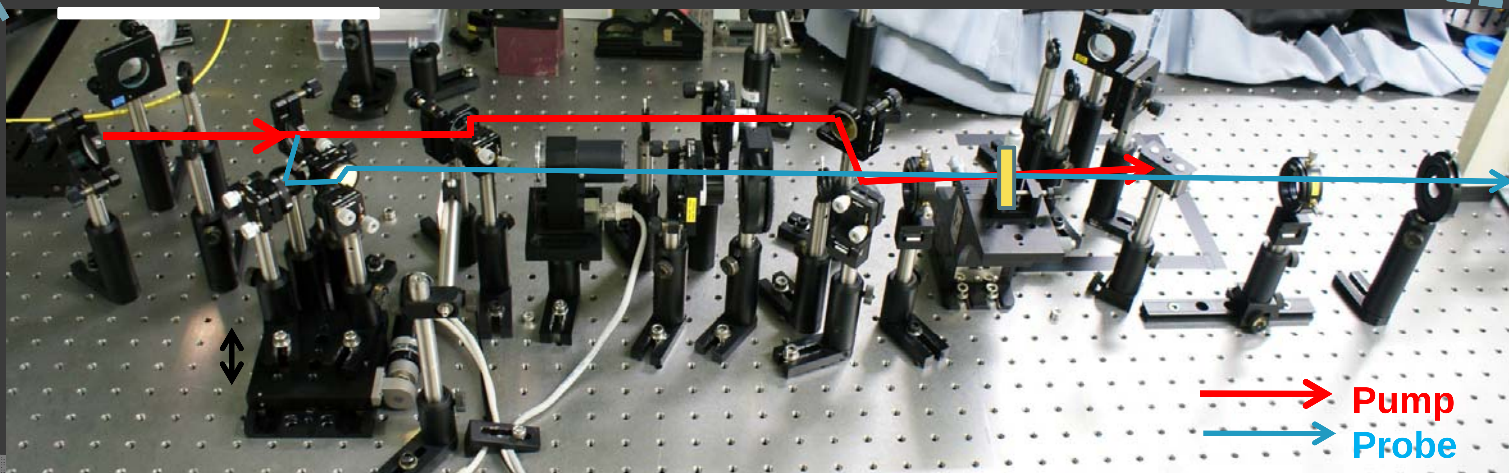
Fourier Transformation of OHD-OKE signal

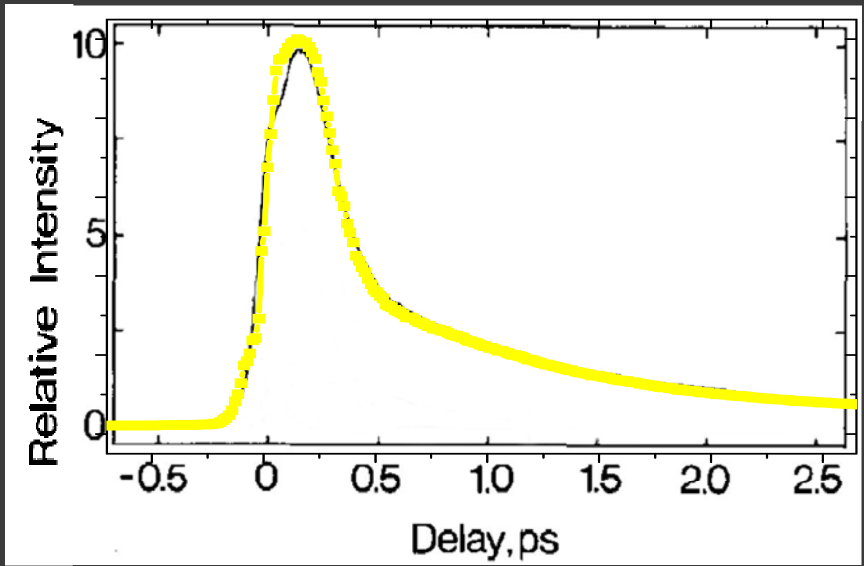
2011 3 12 heesun

OHD-OKE (Optical Heterodyne Detected-Optical Kerr Effect) setup





OHD-OKE signal (sample : CS2)



✓**Signal** $$T(\tau) = \int_{-\infty}^{\infty} G_0^{(2)}(t) R(\tau - t) dt$$

✓**response function** $$R(\tau) = \sigma(\tau) + r(\tau)$$

Electronic response function $\sigma(\tau) = b\delta(\tau)$

nuclear response function $r(\tau) = \sum_i a_i r_i(\tau)$

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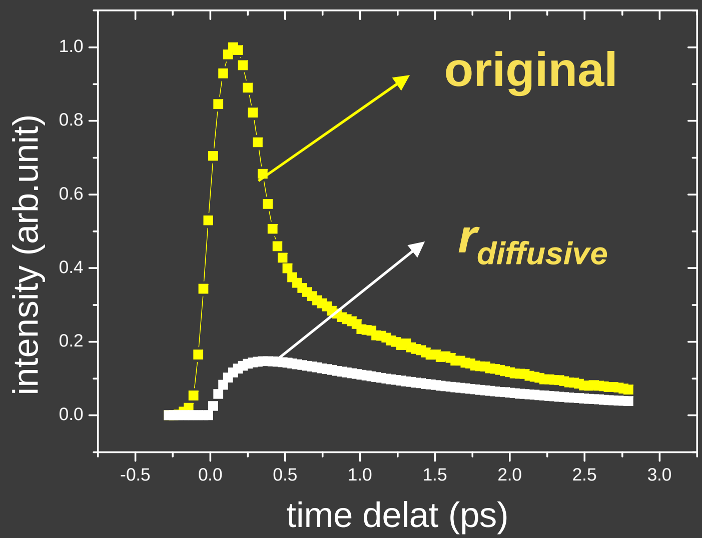
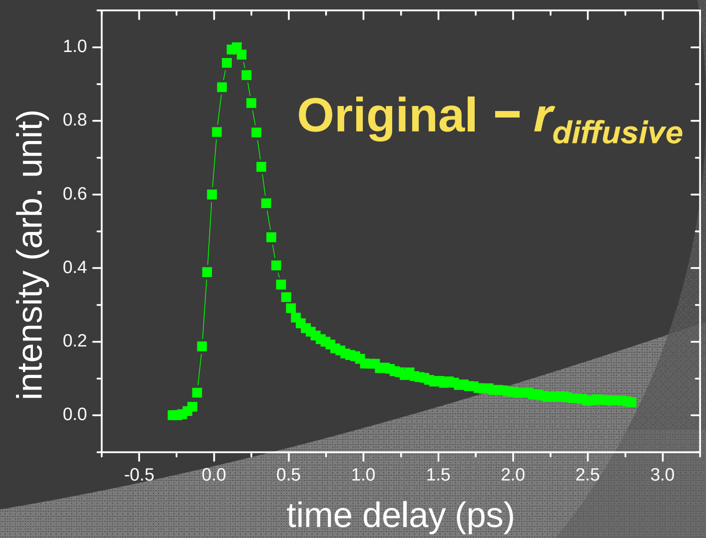
OHD-OKE signal (sample : CS2) fourier transform

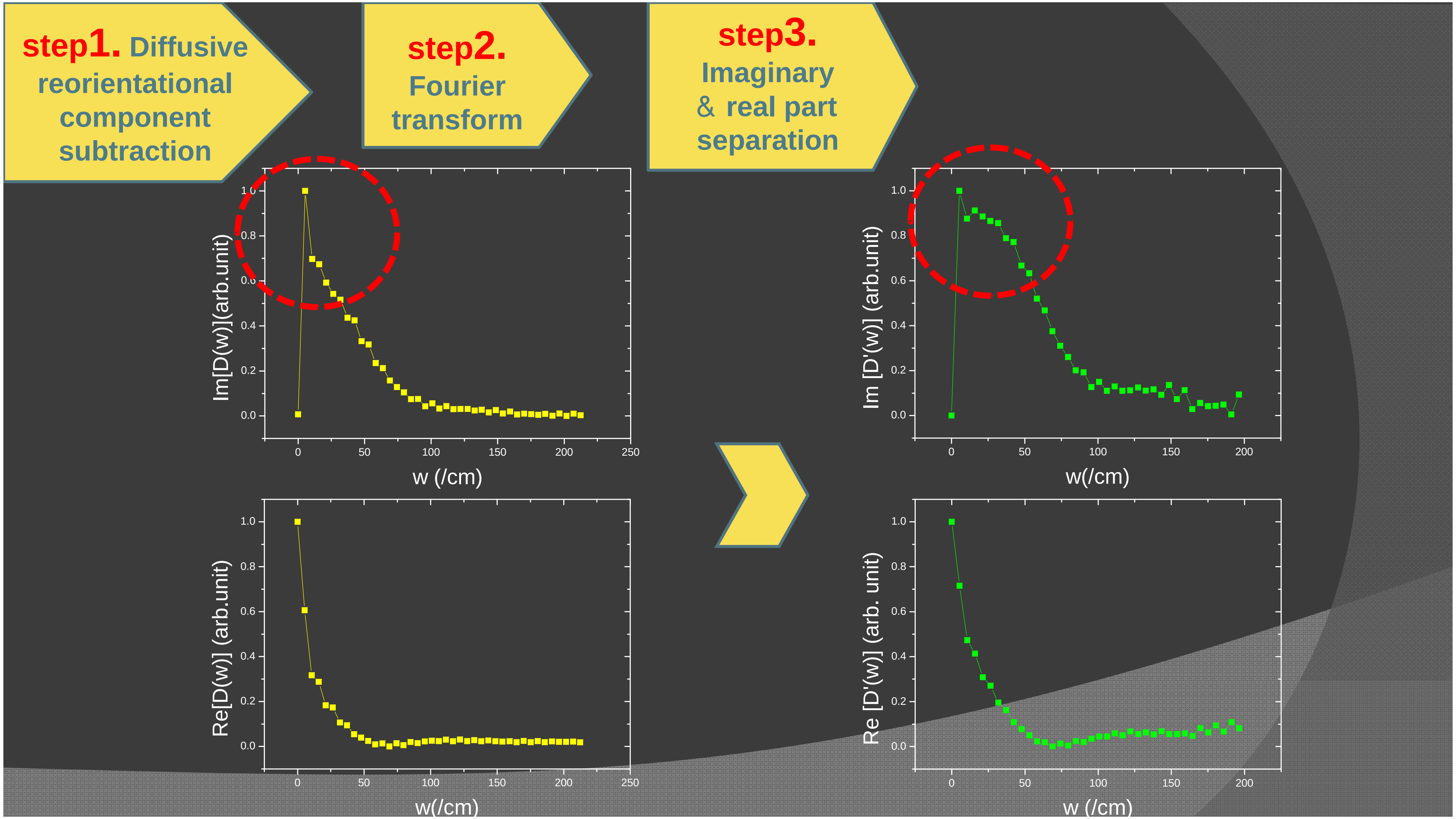
step1.
Substract Diffusive reorientational component

$$r_{diffusive}(\tau) = a\exp(-\frac{\tau}{\tau_{diff}})[1-\exp(-\frac{\tau}{\beta})]$$

'Tail-matched'

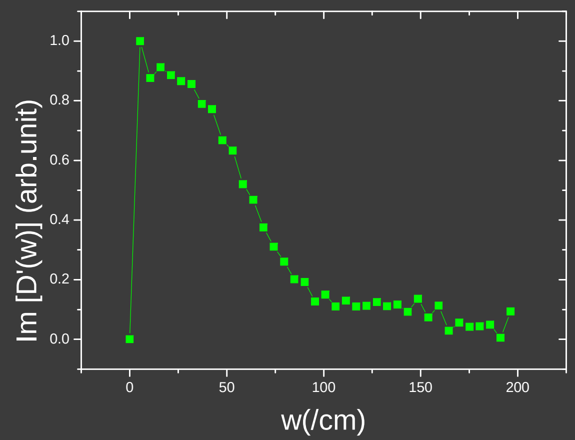


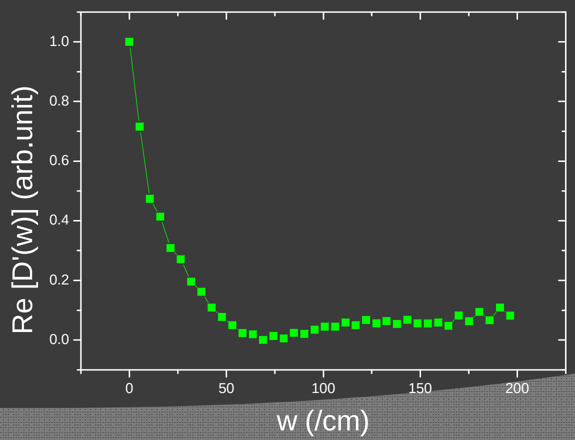



step1. Diffusive reorientational component subtraction
step2. Fourier transform
step3. Imaginary & real part separation
Im[D(w)](arb.unit)
w (/cm)
Re[D(w)] (arb.unit)
w(/cm)
Im [D'(w)] (arb.unit)
w(/cm)
Re [D'(w)] (arb. unit)
w (/cm)

OHD-OKE signal (sample CS2) fourier transform

step3.
Imaginary & real part separation





$$D(\omega) = \frac{\Im[T(\tau)]}{\Im[G_0^{(2)}(\tau)]} = \frac{\Im[G_0^{(2)}(\tau)]\Im[R(\tau)]}{\Im[G_0^{(2)}(\tau)]} \equiv \Im[R(\tau)]$$

$$D(\omega) = \int_{-\infty}^{\infty} R(t)e^{i\omega t}dt = \Im[R(t)]$$

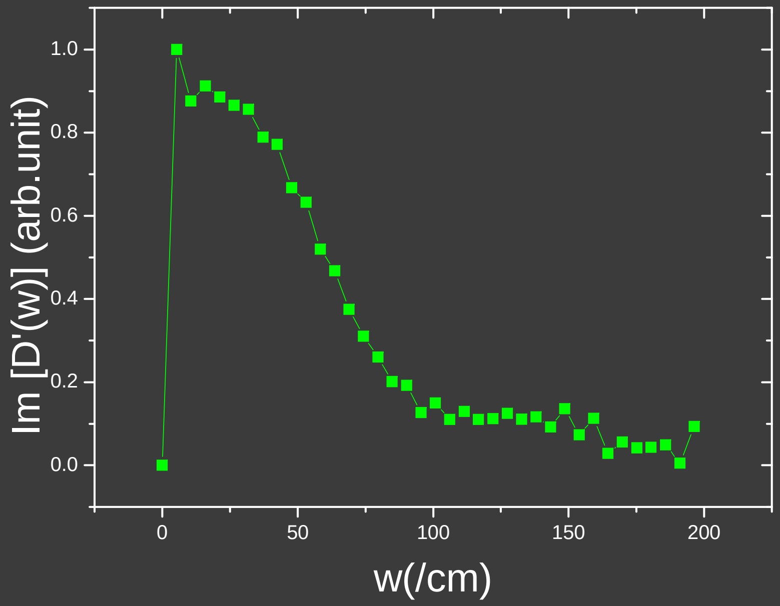
$$R(t) = b\delta(t) + r(t)$$

$$\operatorname{Im} D(\omega) = \operatorname{Im} \Im[r(t)]$$

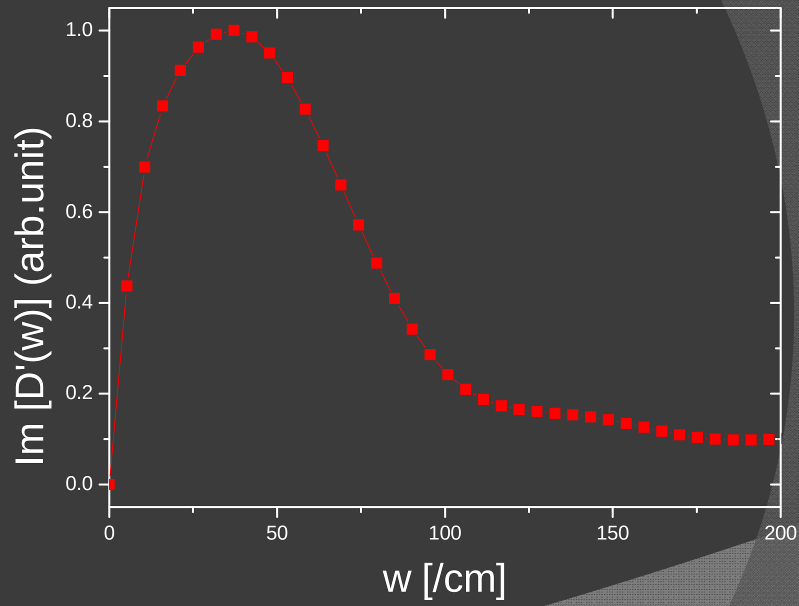
$$\operatorname{Re} D(\omega) = b + \operatorname{Re} \Im[r(t)]$$

OHD-OKE signal (sample : CS2) fourier transform

Raw data

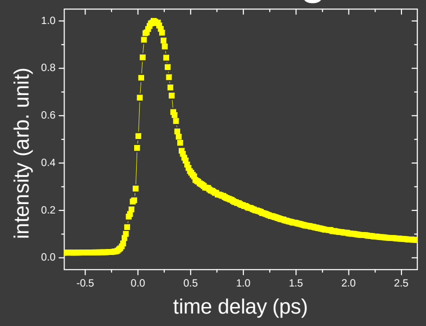


Fitting result

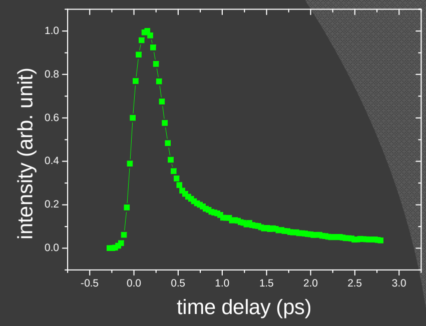


OHD-OKE signal Fourier Transform Process

CS2 Kerr signal



step1.
Substract Diffusive reorientational component



step2.
Fourier transform

step3.
Imaginary & real part separation