

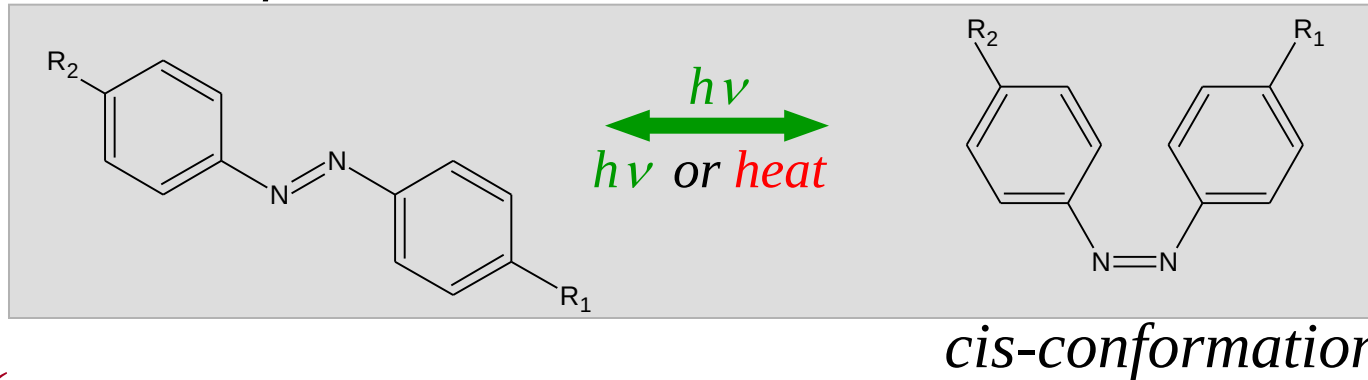
Induced transparency on DR19-Cl (Disperse Red – 19 Cl) solution using picosecond pulses

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Introduction

✓ *Azo-benzene Compounds (fotoisomerization)* *trans-conformation*



✓ *π - Conjugation*

✓ *Increase delocalization of charges*

✓ *Type of compounds*

✦ *Azobenzenes*

✦ *Aminoazobenzenes*

✦ *Pseudo-stilbenes*



DR!9-CI

Motivation

✓ *Resonant and non-resonant nonlinear properties*

+ *Photoisomerization Modeling*

+ *Two photon absorption*  *Fast Optical Limiting*

+ *Absorption of excited states*

➤ *Saturable Absorption*

➤ *Reverse Saturable absorption*

 *Optical Switched*

 *Optical Limiting*

+ *Birefringence*

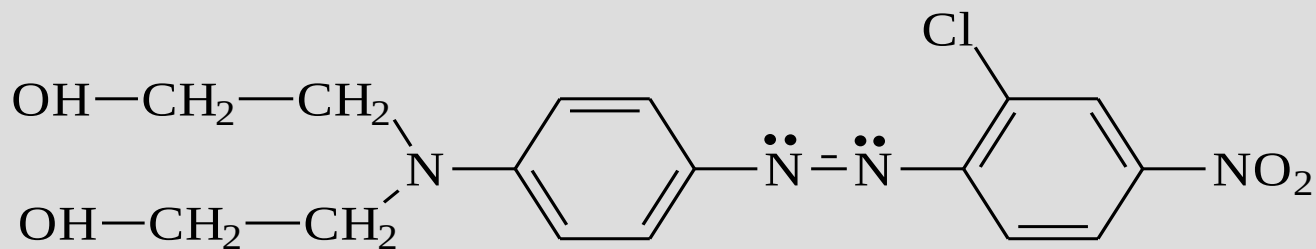
+ *Dichroism*

}

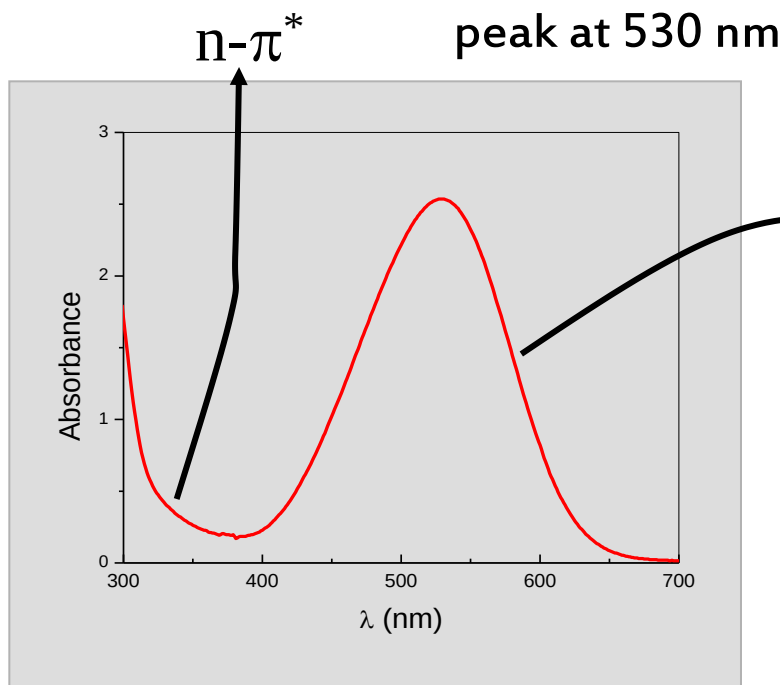
 *Photoisomerization*

+ *Molecular engineering*

DR19-Cl sample



✓ *Linear Absorption in DMSO solvent*



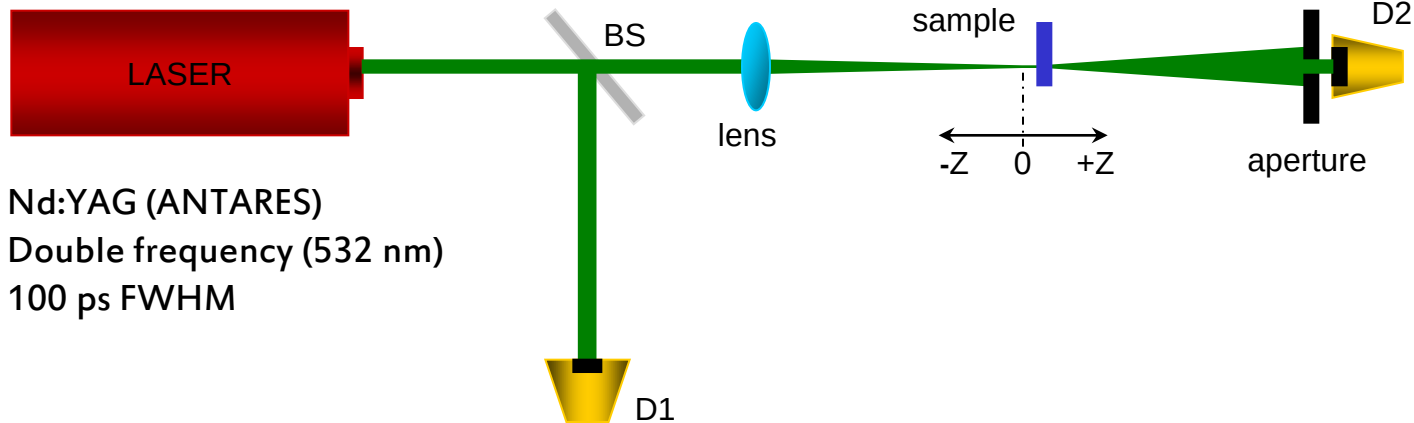
$\pi-\pi^*$

Concentration

$$N_0 = 2.5 \times 10^{17} \text{ molecules/cm}^3$$

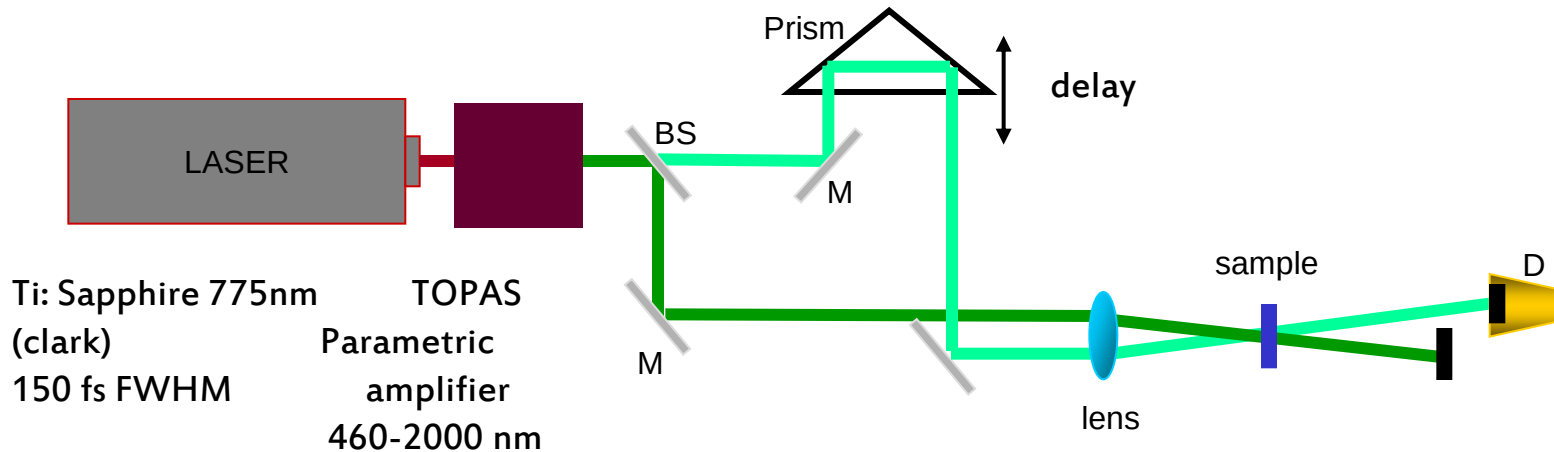
$$\sigma_{\text{trans}}(532 \text{ nm}) = (1,2 \pm 0,1) \times 10^{-16} \text{ cm}^2$$

⚡ *Z-scan technique*



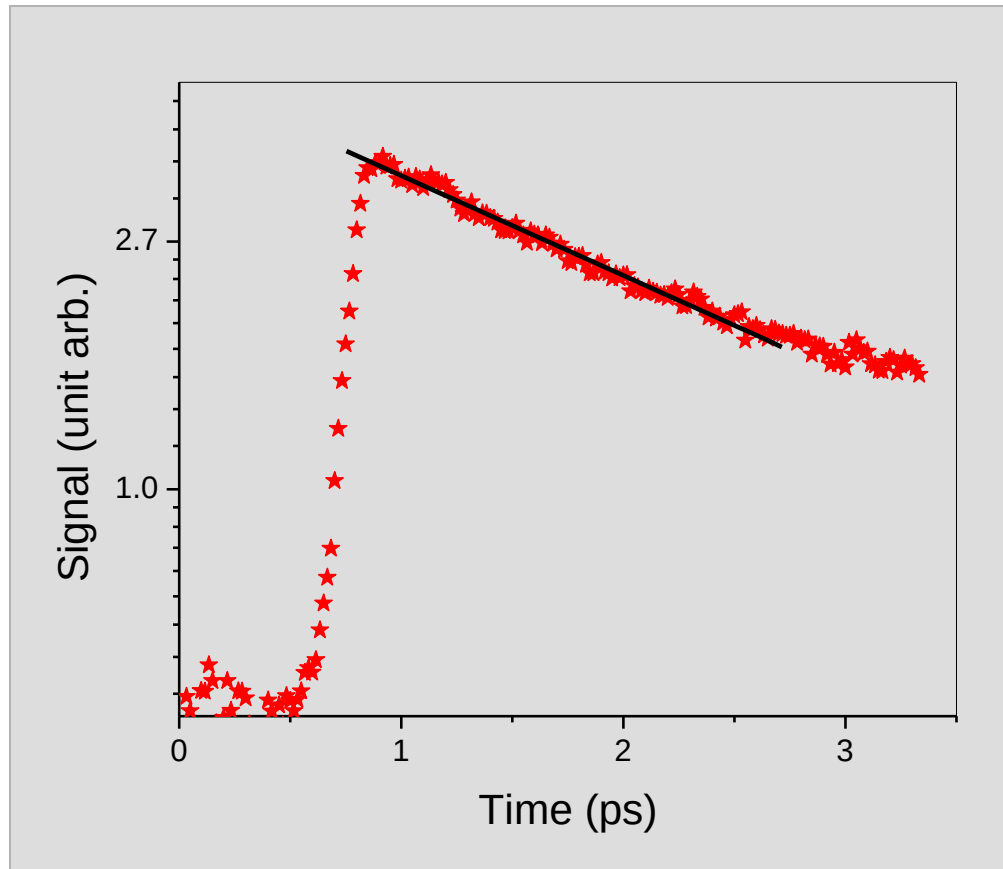
Nd:YAG (ANTARES)
 Double frequency (532 nm)
 100 ps FWHM

⚡ *Pump-probe technique*



Ti: Sapphire 775nm
 (clark)
 150 fs FWHM

⚡ Results (Pump-probe)



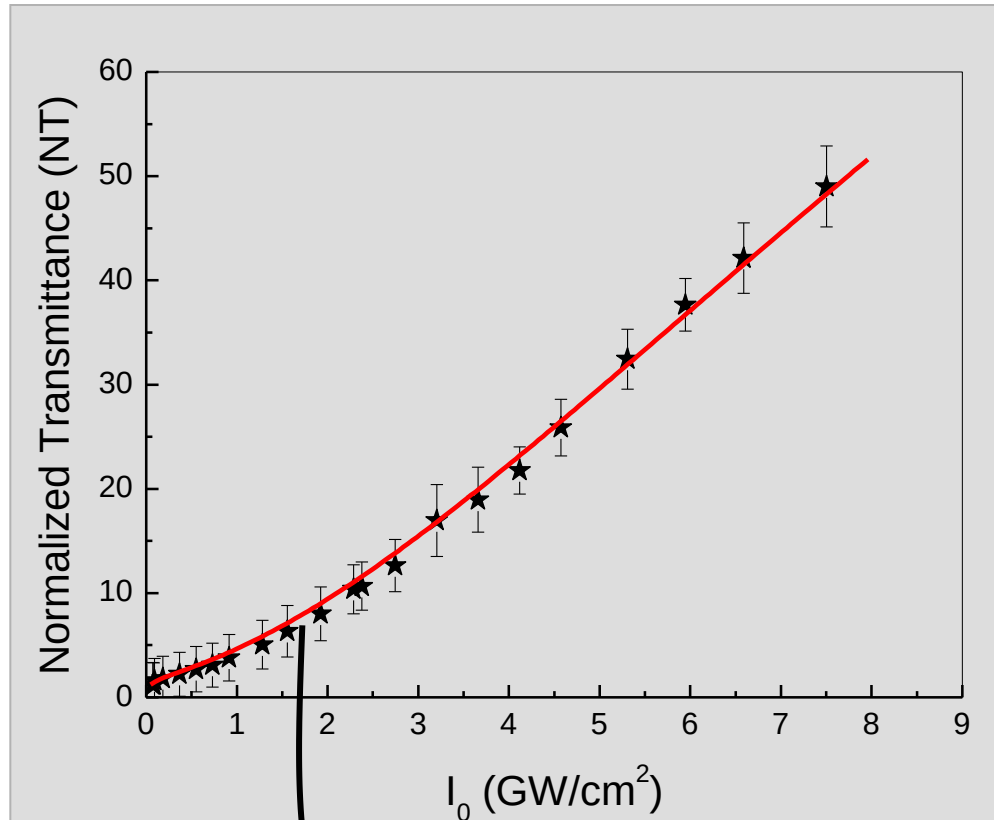
Linear fitting

$$\tau = (2.5 \pm 0.3) \text{ ps}$$

This is the typical fotoisomerization time of azobenzene compounds described in literature.

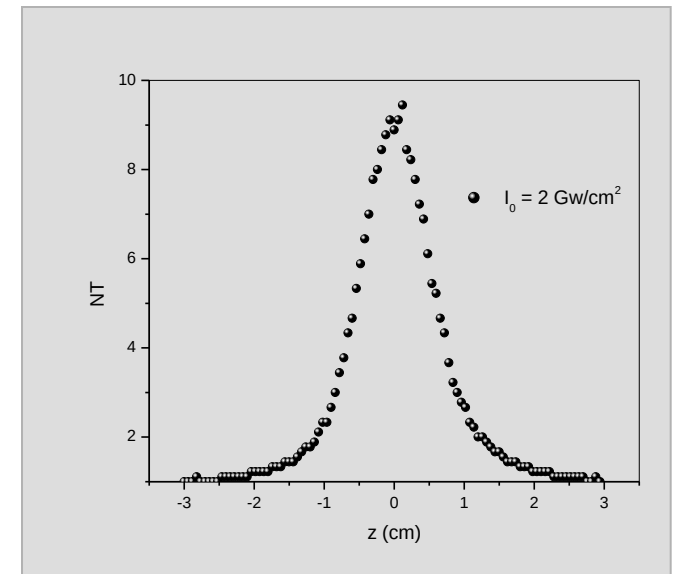
Results (Z-scan)

✓ **Strong Saturable Absorption**



Fitting using three-level energy model

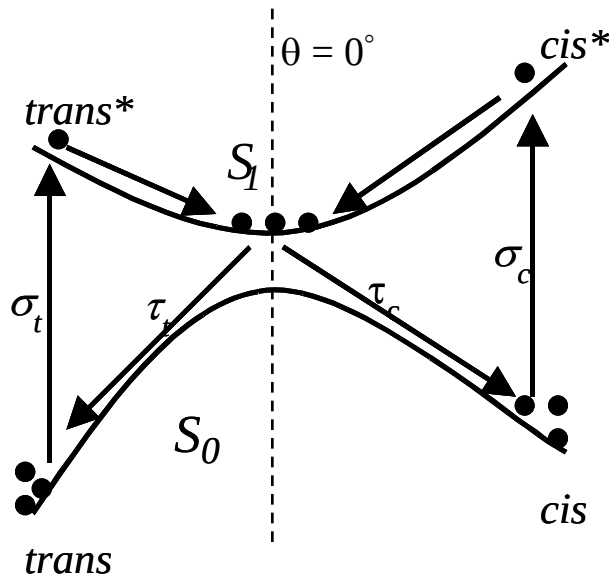
Typical signature of saturable absorption



The transmittance Linear increase
20 %

Discussion

✓ Three-level energy model



Constant parameters

$$\tau_t \text{ and } \tau_c = (2,5 \pm 0,3) \text{ ps}$$

$$\sigma_{\text{trans}} = (1,2 \pm 0,1) \times 10^{-16} \text{ cm}^2$$

Fitting parameters

$$\sigma_{\text{cis}} = (9 \pm 0,3) \times 10^{-17} \text{ cm}^2$$

$$\sigma_{S1} \approx 0$$

Rate equations

$$\frac{dn_t}{dt} = -n_t W_{tS1} + \frac{n_{S1}}{\tau_{S1t}}$$

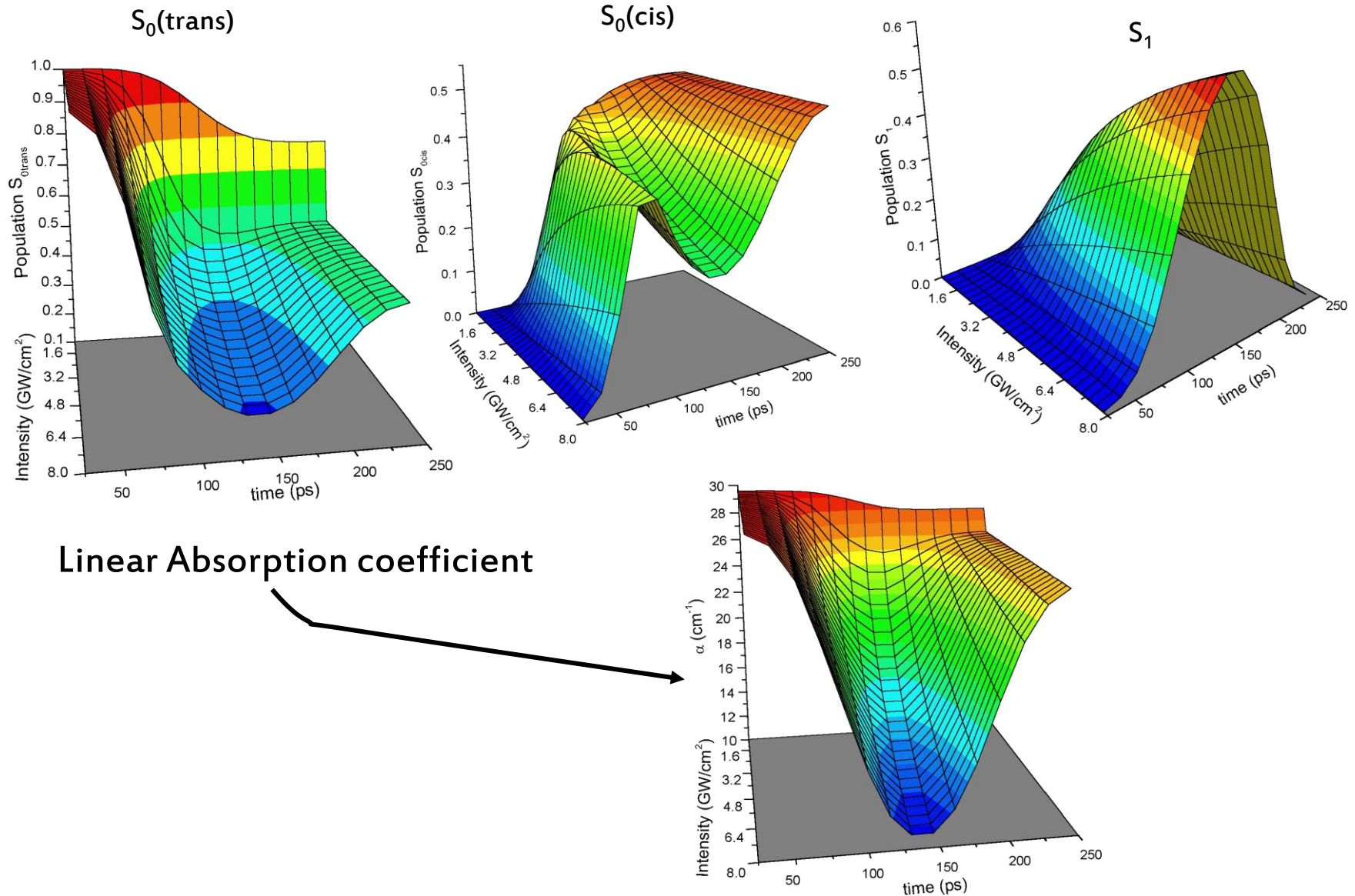
$$\frac{dn_c}{dt} = -n_c W_{cS1} + \frac{n_{S1}}{\tau_{S1c}}$$

$$\frac{dn_{S1}}{dt} = n_t W_{tS1} + n_c W_{cS1} - \frac{n_{S1}}{\tau_{S1c}} - \frac{n_{S1}}{\tau_{S1t}}$$

$$W_{tS1} = \frac{\sigma_t I}{h\nu}; \quad W_{cS1} = \frac{\sigma_c I}{h\nu}$$

$$\alpha(t) = N[n_t \sigma_t + n_c \sigma_c]$$

Intra-pulse population dynamics



Conclusions

- ✓ *The saturable absorption (SA) is the results of the population depletion of the fundamental band*
- ✓ *We have observed a relaxation time of 2.5 ps for DR19-Cl*
- ✓ *This fast “transparence” observed was very high, about 20%*
- ✓ *Using a tree-level energy model we could fit the normalized transmittance ($\sigma_{cis} = (9 \pm 0,3) \times 10^{-17}$ cm²)*