Second Harmonic Generation – Circular Dichroism

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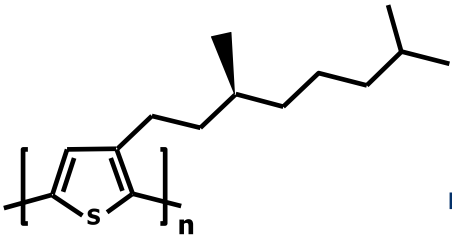
Molecular and nanomaterials

Outline

- **Magneto-optical properties of polythiophenes**
- **SHG-CD**
- **Experimental Setup**
- **Results**
- **Collaborations within INPAC**
- **Acknowledgements**

Polythiophenes



n = 50 - 100

Conjugated backbone

Highly regioregular

Organic electronics

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MO-properties of polythiophenes

- Very large Verdet-constant: $\theta = V\ B\ l$
  $V = 25 * 10^5\ °\ T^{-1}\ m^{-1}$

  P. Gangopadhyay, S. Foerier, G. Koeckelberghs, M. Vangheluwe, T. Verbiest, A. Persoons, Proc. of SPIE 6331 (2006)
- Magnetic contributions to Second Harmonic Generation

$$\mathbf{P}_i(2\omega) = \chi^{eee}_{ijk}\mathbf{E}_j\mathbf{E}_k + \chi^{eem}_{ijk}\mathbf{E}_j\mathbf{B}_k$$
$$\mathbf{M}_i(2\omega) = \chi^{mee}_{ijk}\mathbf{E}_j\mathbf{E}_k$$

S. Van Elshocht, T. Verbiest, M. Kauranen et al., J. Chem. Phys. 107, 8201-8203, 1997

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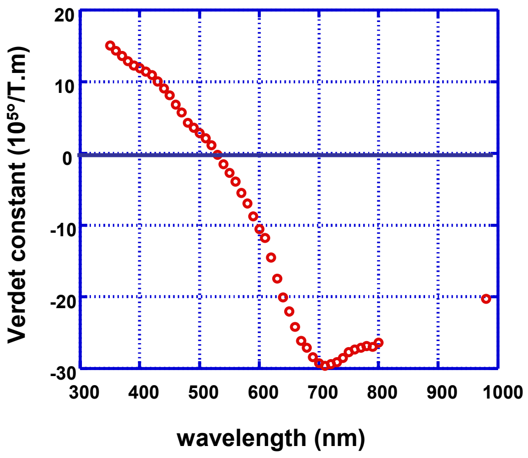
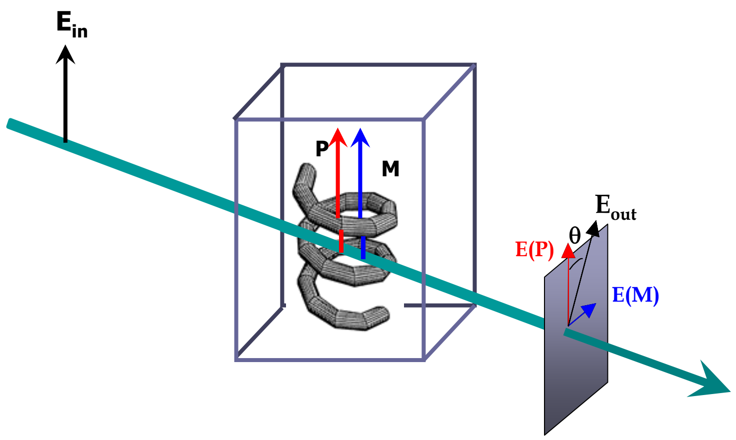
MO-properties of polythiophenes

Is there a relationship between the dispersion of the Verdet-constant and the magnetic contributions in SHG?

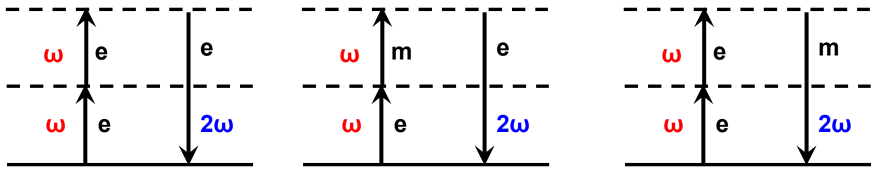


Chirality

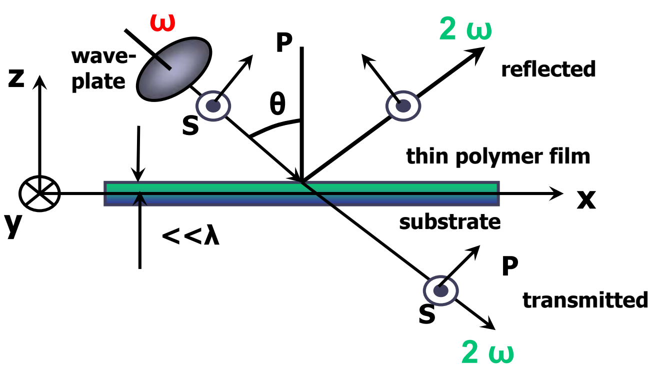


Chirality in nonlinear optics

- Nonlinear optical analogues of OR, CD, LD
- Molecular origin of chirality:
  - “one-electron on a helix”: electric AND magnetic transitions
  - “coupled oscillators”: only electric transitions
- Chiral polythiophenes: both electric and magnetic transitions



Experimental Geometry

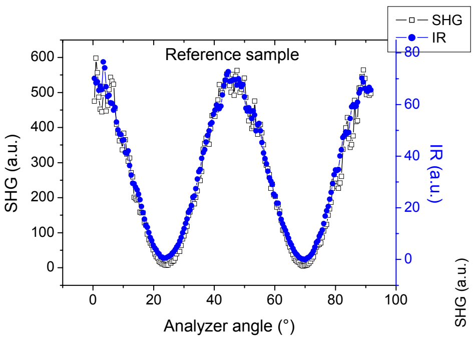


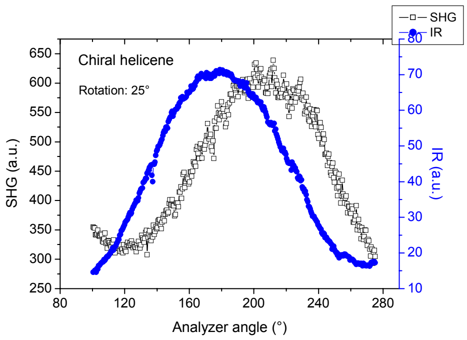
- Vary input polarization via waveplates
- Detect s- & p- polarized components in reflection and transmission

Experimental Setup

- Tunable, amplified femtosecond system
- λ: 1100-1600nm
- Rep. rate: 1kHz
- Pulsewidth: 100-150fs
- Av. Power: 30mW

Preliminar results





	1300nm	1200nm	1140nm
Helicene	2.9°	9.7°	25.2°

Possible collaborations within INPAC

- Shared setup (VSM), some technical issues left
- Any structure can be measured in SHG, SFG,… at different wavelenghts

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