On Nonlinear Optical Properties of Polystyrene
M. Jahja¹ and C. Bubeck²

¹Jurusan Fisika Universitas Negeri Gorontalo Jl. Jend. Sudirman 6, 96128, Gorontalo, Indonesia
²Max-Planck-Institute for Polymer Research, Ackermannweg 10, D-55128, Mainz, Germany

Introduction
Polystyrene has found known applications in integrated optics as passive waveguides [1], and also as active waveguides. Hu et al. demonstrated all-optical switching process in a polystyrene photonic crystal [2].

\[ n = n_0 + n_2 I \]
\[ \alpha = \alpha_0 + \alpha_2 I \]

Questions:
- What are the linear and cubic nonlinear properties relevant for all-optical switching?

Task: Measure \( n_2 \) and \( \alpha_2 \) at 532 nm

Polystyrene
Polystyrenes are commercially available

Polystyrene or PS
\( M_w = 1,300,900 \) g/mol

Molecular structure of Polystyrene

Linear Optical Properties
Films were made by spin coating from chlorobenzene solution onto fused silica substrates

Experimental Setup

Intensity dependent prism coupling

Results

Parameters \( (d, n, \lambda) \) were measured and \( d \) was determined at low intensity. All parameters were kept constant. Only the incident intensity \( I_0 \) was varied and two parameters \( (n_2, \alpha_2) \) were used to fit the intensity dependent coupling curves [3].

Conclusion:
- \( n_2 \) and \( \alpha_2 \) values of PS are \( 2.6 \times 10^{-14} \) cm²/W and \( 1.5 \times 10^{-10} \) cm/W, respectively.
- The value of \( n_2 \) of PS reported by Hu et al.[2] is about 23 times higher of \( n_2 \) of ours.