**Nonlinear Optics**

Prof. Koby Scheuer

Course number: 0510.6602

1. **The nonlinear optical susceptibility**: the wave equation and the polarization vector, temporal and tensorial description of the linear and nonlinear susceptibility, the classical anharmonic oscillator model for 2nd order nonlinearity
2. **Second order processes with monochromatic light**: coupled mode equations for three wave mixing, phase matching, Sum-frequency-generation, Difference-frequency-generation, optical parameteric oscillators, The electrooptice effect – fomrlaism and modulators
3. **The intensity dependent refractive index – basics**: The optical Kerr effect, Tensorial description of the 3rd order nonlinear susceptibility, the classical anharmonic oscillator model for 3rd order nonlinearity
4. **The intensity dependent refractive index – spatial effects**: self-focusing, optical phase conjugation by four-wave-mixing, optical bistability
5. **The intensity dependent refractive index – temporal effects**: characterization of optical pulses and their propagation, self-phase modulation, solitons
6. **Light scattering:** general features, Brillouin scattering (spontaneous and stimulated), Raman scattering (spontaneous and stimulated)
7. **Extreme nonlinear optics** (if time permits): Tunnel ionization and High-Harmonic generation.
8. **Semiconductor nonlinear optics** (if time permits)

**References:**

1. R. W. Boyd, ”Nonlinear optics, 3rd edition", 2008 Academic Press

**Grading:** Final exam 90%, Home assignments 10%

**Exercises**: Solutions will be posted after the submission deadline