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Experimental physics 3 for physicists

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https://www.mpl.mpg.de/divisions/leuchs-division/teaching/

Problem sheet 13

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Problem 1: Revision questions

- What are Maxwell's equations and what do they say?
- Write down the wave equation for electromagnetic waves in vacuum and name a solution to this equation.
- Compare plane waves to Gaussian pulses. What do their spectra look like?
- What is the relationship between pulse duration and spectral width?
- Why is the sky blue during daytime and red at sunset (if not rainy or cloudy)?
- If you look outside the window in an illuminated room, you can see your reflected image. Why is it only clearly visible at night?
- What is a matter wave?
- What is the difference between phase and group velocity?
- What does a dispersion relation describe?
- How can one polarize light by means of a glass plate?
- Due to what effect can light be confined and propagate in an optical fiber?
- Construct the image of an object through a thin lens by means of ray optics.
- What is the principal plane in ray optics?
- How should a plano-convex lens be placed best for focusing a collimated beam?
- What types of lens aberrations do you know?
- What is the conceptual difference between a microscope and a telescope?
- Name the basic components of a laser and explain them briefly.
- What transitions can take place in a 2-level system?
- Sketch the structure and function of a Fabry-Perot interferometer.
- How is the diffraction pattern in the far field related to the diffracting object?
- What parameters (combination) can describe a Gaussian beam completely?
- How is the spectral energy density $|E(\omega)|^2$ of a light beam related to the time evolution of its electric field?
- What is coherence?