CPP 18: Light-Induced Phenomena

Time: Wednesday 14:30–15:45 Location: H40

CPP 18.1 Wed 14:30 H40

Tuning phonon spectra of two-dimensional colloidal crystals — •Jörg Baumgartl[1], Maria Zvyagolskaya[1], Hans Henning von Grünberg[2], and Clemens Bechinger[1] — [1]Universität Stuttgart, 2.Physikalisches Institut, Pfaffenwaldring 57, D-70569 Stuttgart, Germany — [2]Karl-Franzens-Universität, Institut für Chemie, Heinrichstraße 28, A-8010 Graz, Austria

By exposing two-dimensional (2D) colloidal crystals to tunable substrate potentials one can selectively manipulate the corresponding phonon band-structure. We explore this idea theoretically and experimentally by studying the overdamped lattice dynamics of colloidal crystals subjected to one- and two-dimensional periodic substrate potentials which are created by interfering laser beams. Experimentally, the phonon spectrum is obtained from the particle dynamics observed by videomicroscopy whereas the theoretical analysis is based on a calculation of the elastic energy of a 2D crystal in the presence of a substrate potential using the harmonic approximation. Depending on the geometry and the strength of the underlying lattice potential, the phonon spectra can be substantially changed which is in agreement with our theoretical calculations.

CPP 18.2 Wed 14:45 H40

Laser-induced phonon-phonon interactions in bismuth — •Eeuwe Sieds Zijlstra and Martin Garcia — Theoretische Physik, Fachbereich Naturwissenschaften, Universität Kassel, Heinrich-Plett-Str. 40, 34132 Kassel, Germany

We compute laser-induced interactions between coherent phonons in bismuth and demonstrate that they are key to understanding important experiments performed with intense femtosecond laser pulses. In particular, we find mixing signals and higher harmonics arising from the coupling between phonons of different and the same symmetries, respectively. We show that the phonon-phonon interaction is strongly dependent on the laser fluence and is for that reason only observable when sufficiently strong laser pulses are used. Our results offer a unified description of the different experimental observations performed so far on bismuth.

CPP 18.3 Wed 15:00 H40

Reversible and Irreversible Photobleaching of Organic Dyes in Polymers — •Jörg Schuster, Jörg Brabandt, and Christian von Borczyskowski — Center for nanostructured materials and analytics, TU Chemnitz, 09107 Chemnitz

The photoinduced decay of fluorescence of organic dyes (photobleaching) is usually discussed in terms of irreversible photochemical modifications of the dye molecules (often photooxidation). We can show now, that the fluorecence decay from a number of dyes is mostly reversible in the initial part. The reversible decay is due to fluorescence intermittency with power law distributed on- and off- intervals (blinking) [1,2].

By measuring the recovery of the initially bleached lumincescence after a given waiting time as a function of the bleaching time we are able to discriminate the reversible and irreversible fraction of the luminescence decay. The finding, that an intermittency induced photophysical bleaching process dominates the initial stages of photobleaching may shine new light on the puzzling variety of data on nonexponential photobleaching kinetics which has been published in the literature on photobleaching during the past decades. Once deconvoluted, the irreversible photochemical bleaching kinetics follows a simple single exponential decay. The photophysical bleaching is assigned to the photoejection of charges into the polymer. This reversible photoionisation process takes place on time scales from milliseconds to minutes.

[1] Schuster et al., Appl. Phys. Lett. 87 (2005), 051915
[2] Schuster et al., J. Luminescence, in press

CPP 18.4 Wed 15:15 H40

Molecular tracer diffusion in thin azobenzene polymer layers — •Norman Mechau[1,3], Marina Saphiannikova[2], and Dieter Neher[1] — [1]Institute of Physics, University of Potsdam, Am Neuen Palais 10, 14469 Potsdam, Germany — [2]Leibniz Institute of Polymer Research, Hohe Straße 6, 01069 Dresden, Germany — [3]Forschungszentrum Karlsruhe, Institut of Nanotechnology, 76021, Karlsruhe, Germany

Translational diffusion of fluorescent tracer molecules in azobenzene polymer layers is studied at different temperatures and under illumination using the method of fluorescence recovery after photo-bleaching. Diffusion is clearly observed in the dark above the glass transition temperature, while homogenous illumination at 488 nm and 100 mW/cmˆ2 does not cause any detectable diffusion of the dye molecules within azobenzene layers. This implies that the viscosity of azobenzene layers remains nearly unchanged under illumination with visible light in absence of internal or external forces.

CPP 18.5 Wed 15:30 H40

Ortsaufgelöste Messung der thermischen Leitfähigkeit in Flüssigkeiten* — •Judith Schwesyg, Helge Eggert, Dirk Apitz und Karsten Buse — Physikalisches Institut, Universität Bonn, Wegelerstr. 8, 53115 Bonn

Bildgebende Verfahren sind in vielen Bereichen der Wissenschaft und Technik von fundamentaler Bedeutung. Hierbei werden verschiedenste Kontrastmechanismen benutzt, z. B. Absorptions-, Brechungsindex- und Temperaturunterschiede. Ein neuer Ansatz ist, als Kontrast Inhomogenitäten der Wärmeleitfähigkeit in Flüssigkeiten oder Festkörpern zu messen und bildlich darzustellen. In diesem Vortrag wird ein pulsholographisches Verfahren vorgestellt, mit dem es gelingt, die thermische Leitfähigkeit in Flüssigkeiten ortsaufgelöst zu messen. Es basiert auf der Tatsache, dass vom Zerfall thermischer Gitter, die durch Beleuchtung mit zwei interferierenden Nanosekundenlichtpulsen erzeugt wurden, auf die thermische Leitfähigkeit geschlossen werden kann. Als Beispielsystem dient das Zweikomponentensystem Toluol-Wasser. Es werden Messergebnisse sowie die aus diesen erstellten zweidimensionalen Bilder präsentiert. Des Weiteren tritt durch die Pulsbeleuchtung ein Grenzflächeneffekt auf: Von der Grenzschicht gehen aufgrund unterschiedlicher Material-Kompressibilitäten Schallwellen aus, die durch Beugung nachgewiesen werden. Dieser Effekt kann ebenfalls zur Bildgebung genutzt werden.

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