K 9: Poster

Zeit: Donnerstag 16:30–18:30 Raum: Foyer Nordbau

K 9.1 Do 16:30 Foyer Nordbau

3D printing of complex submillimeter-sized wide angle objectives — •Zhen Wang[1], Ksenia Weber[1], Simon Thiele[2], Alois Herkommer[2], and Harald Giessen[1] — [1]4th Physics Institute and Research Center SCoPE, University of Stuttgart — [2]Institute of Technical Optics and Research Center SCoPE, University of Stuttgart

Compact image sensors with a variety of focal lengths, fields of view, and other optical parameters, will be the enabling technology of integrated devices for industry 4.0. In order to miniaturize the imaging devices from currently several mm^3 to below 1 mm^3, and to achieve diameters of the optics below 1 mm, 3D printing with femtosecond laser pulses is the method of choice.

Here, we present several multi-lens designs as well as printed objectives with fields of view that range from 60° to 95°, and focal lengths in the range of 200-300 micrometer, with diameters around 800 micrometer, which allow for wide-angle imaging. We characterize their performances and report how to overcome some issues when printing such challenging designs. In the future, those objective can be directly printed onto CMOS imaging chips which will enable very compact image sensors.

K 9.2 Do 16:30 Foyer Nordbau

3D printed antireflection coating — •Rebecca Rühle, Michael Schmid, and Harald Giessen — 4th Physics Institute University of Stuttgart

3D printed micro-optics have been greatly improved in recent years. Especially in applications such as endoscopy or sensor technology, their importance is gaining momentum. The image quality of existing optics is reduced by reflection losses. To reduce these reflections, antireflection coatings are applied. A possibility of such an antireflective layer are small protuberances on the surface, which are called moth eyes.

With the help of the 3D printer Photonics Professional from Nanoscribe GmbH such moth eyes are produced. Different methods for compensating the tilt of the glass substrate were investigated. The distance of the moth eyes, the laser power, and the height of the moth eyes were varied to find out which settings have the best characteristics of the moth eyes in the visual wavelength range. Subsequently, the moth eyes were successfully printed on a spherical surface in a one-step process. In a two-step process, an attempt was made to print the moth eyes on a spherical cut with different photoresists.

K 9.3 Do 16:30 Foyer Nordbau

Theoritical description of Surface Plasmons Polaritons — •Benhayoun Othmane — Universität Kassel, Kassel, Germany

Surface plasmons-polaritons (SPPs) are collective electronic excitations existing at the metal-dielectric interface, created under certain conditions, by the interaction of surface plasmons in the metal and an incident light. Using merely Maxwell*s equations, one can, with an appropriate ansatz, deduce some qualitative properties of SPPs, such as their wavelength, propagation length and penetration depth into both the dielectric and the metal. However not much is known about how they transfer energy to the lattice, their interaction with light or their damping process. Here we use, as was made by Ritchie [1], a hydrodynamical approximation modeling the surface plasmons interacting with a laser source, in order to attempt answering these questions.

K 9.4 Do 16:30 Foyer Nordbau

Void formation in glasses by single ultra-short laser pulses — S. Lai[1,2,3], •M. Ehrhardt[1], P. Lorenz[1], B. Han[3], and K Zimmer[1] — [1]Leibniz Institute of Surface Engineering (IOM), Permoserstr. 15, 04318 Leipzig, Germany — [2]School of Science, Nanjing University of Science & Technology, Xiaolingwei 200, Nanjing 210094, China — [3]Advanced Launching Co-innovation Center, Nanjing University of Science & Technology, Xiaolingwei 200, Nanjing 210094, China

The formation of voids developing bubbles near the surface of a soda-lime glass induced by single ultra-short laser pulses ($\lambda = 775$ nm, tpulse = 150 fs) will be shown. The void-forming semi-spheres with diameters up to 3 um. Cross sectioning cut by focused ion beam shows an ellipsoidal void inside the laser irradiated volume with an upper shell which has a thickness of approx. 100 nm. The voids are formed in a narrow fluence range between inside glass modification and ablation. The void forming mechanism will be discussed based on a nonlinear absorption process near the surface and subsequently thermalization of the hot electrons.

K 9.5 Do 16:30 Foyer Nordbau

Cavitation Dynamics Studied by Time-Resolved High-Resolution X-Ray Holography at European XFEL — •Hannes P. Hoeppe[1], Juan M. Rosello[2], Malte Vassholz[1], Thomas M. Kurz[2], Robert Mettin[2], Johannes Hagemann[1], Markus Osterhoff[1], Christian G. Schroer[3], Andreas Schropp[3], and Tim Salditt[1] — [1]Institut für Röntgenphysik, Universität Göttingen, Germany — [2]3. Phys. Institut, Universität Göttingen, Germany — [3]Deutsches Elektronen-Synchrotron, Hamburg, Germany

Cavitation dynamics are of great interest, since they are held responsible for erosion and are important for ultrasonic cleaning, sonochemistry and medicine. The compression of bubbles can lead to a violent collapse with extreme states of heat and pressure. In this state the bubble radius is at sub-micron scale with temporal changes in sub-ns regime. This state of cavitation has not been resolved yet, as it brings the optical observation methods to its limits. X-ray holography with single free-electron-laser pulses overcomes these limits and is therefore the optimal method for the investigation of extreme states of cavitation.

This contribution describes a time-resolved high-resolution x-ray holography experiment to study cavitation dynamics, scheduled in June 2019 at the European XFEL. The experiment aims to image spatially and temporally the extreme states of bubble formation in water during their collapse. Cavitation is induced by a short laser pulse and enhanced by ultrasonic fields. The bubble collapse is imaged with near-field holography by fs-FEL pulses. We will present the current state of preparation and first results from in-house experiments.

K 9.6 Do 16:30 Foyer Nordbau

μTRLFS: Spatially- and time-resolved laser fluorescence spectroscopy of Eu(III) sorption on different granites — •Konrad Molodtsov[1,2] and Moritz Schmidt[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR) — [2]TU Dresden

Time-resolved laser fluorescence spectroscopy (TRLFS) is a widely used method to obtain information about the surrounding chemical environment of fluorophores with trace concentration sensitivity. This method allows determining the symmetry and grade of complexation of the fluorophore and provides information about the surrounding quenchers, mainly water as well. For highly heterogeneous systems however distinguishing and separating multiple binding species becomes an unsolvable problem. In this study a new method called μTRLFS is introduced, which will add a spatial dimension to TRLFS, giving the possibility to separate a multi-phase system into discrete single-phase systems. Because of its advantageous fluorescence properties we use europium as an analogue for Am(III) and Cm(III) to study the sorption behaviour of granite as a possible host rock for high-level nuclear waste repositories. Spatially-resolved sorption experiments with Eu(III) on different granite samples are presented. These samples are excited by a focused and pulsed UV laser beam, and scanned with a resolution of 20 μm. Through this approach it becomes possible to characterize Eu(III) sorption on single grains of the complex material by mapping fluorescence intensity, band ratios, as well as lifetimes to visualize the sorption capacity and speciation distribution.

K 9.7 Do 16:30 Foyer Nordbau

Temporal and spatial characteristics of valence holes created by X-ray irradiation in LiF — •Vladimir Lipp[1], Nikita Medvedev[2,3], and Beata Ziaja[1,4] — [1]Center for Free-Electron Laser Science (CFEL) at DESY, Hamburg, Germany — [2]Institute of Physics, Academy of Science of Czech Republic, Prague, Czech Republic — [3]Institute of Plasma Physics, Academy of Science of Czech Republic, Prague, Czech Republic — [4]Institute of Nuclear Physics, Polish Academy of Sciences, Krakow, Poland

Our in-house classical Monte-Carlo simulation tool XCascade-3D [1] follows the electron cascades in time and space for the case of low X-ray fluences. Given the parameters of the X-ray beam, the model calculates spatial and temporal distributions of the electrons and core-shell and valence holes in various X-ray-irradiated materials, including LiF. For this material, the model provides the final distribution of the created valence holes. These holes, after self-trapping, via exciton decay mechanism, contribute to the creation of long-living defects called color centers. Therefore, the present calculations should enable us to establish a connection between the spatial distribution of the X-ray-induced color centers in LiF and the spatial shape of the X-ray beam, as suggested in [2] – with potential experimental applications. References: [1] Lipp, Medvedev, Ziaja, Proc. SPIE 10236, 102360H (2017). [2] Pikuz, Faenov, Matsuoka et al., Scientific Reports 5, 17713 (2015).