FEMTO-ST Colloquium

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Prof. MARTIN WEGENER

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Karlsruhe Institute of Technology (KIT)

Wednesday, November 30th, 2022
9.30

Amphi Émilie du Châtelet
ENSMM, Besançon

After completing his PhD in physics in 1987 at Johann Wolfgang Goethe-Universität Frankfurt (Germany), he spent two years as a postdoc at AT&T Bell Laboratories in Holmdel (U.S.A.). From 1990-1995 he was professor (C3) at Universität Dortmund (Germany), since 1995 he is professor (C4, later W3) at Institute of Applied Physics of Karlsruhe Institute of Technology (KIT). Since 2001 he has a joint appointment as department head at Institute of Nanotechnology of KIT. From 2001-2014 he was the coordinator of the DFG-Center for Functional Nanostructures (CFN) at KIT. His research interests comprise ultrafast optics, (extreme) nonlinear optics, near-field optics, optical laser lithography, photonic crystals, optical, mechanical, and thermodynamic metamaterials, as well as transformation physics. This research has led to various awards and honors, among which are the Alfried Krupp von Bohlen und Halbach Research Award 1993, the Baden-Württemberg Teaching Award 1998, the DFG Gottfried Wilhelm Leibniz Award 2000, the European Union René Descartes Prize 2005, the Baden-Württemberg Research Award 2005, the Carl Zeiss Research Award 2006, and the SPIE Prism Award 2014 for the start-up company Nanoscribe GmbH.

femto-st SCIENCES & TECHNOLOGIES

3D LASER MICRO- AND NANOPRINTING

Following a brief introduction into 3D laser printing on the micrometer and nanometer scale based on two-photon absorption [1,2], I will emphasize recent progress of my group in this field. This includes replacing two-photon absorption by one-color two-step absorption, allowing to use compact and inexpensive continuous-wave lasers rather than femtosecond laser systems [3].

Using two-color two-step absorption combined with the idea of light-sheet laser printing [1,4], we have more recently achieved print rates approaching 107 voxels/s.

Aligning the director of liquid-crystal elastomers during the 3D laser printing process yields 3D micro-architectures that can be actuated by light from an LED [5].

Finally, I briefly discuss recent unpublished [6] progress in regard to laser printing of functional microelectronic devices such as diodes, memristors, and transistors. Here, introducing laser-induced photothermal synthesis of inorganic semiconductors such as ZnO has been crucial.

Keywords : laser printing, two-photon absorption, two-step absorption, light-sheet 3D printing, 3D metamaterials, printed electronics, 4D printing

[1] V. Hahn et al., "3D Laser Nanoprinting," Opt. Photonics News 30, 28 (2019).

[2] V. Hahn et al., "Rapid assembly of small materials building blocks (voxels) into large functional 3D metamaterials," Adv. Funct. Mater. 30, 1907795 (2020).

[3] V. Hahn et al., "Two-step absorption instead of two-photon absorption in 3D nanoprinting," Nature Photon. 15, 932 (2021).

[4] V. Hahn et al., "Light-sheet three-dimensional microprinting via two-colour two-step absorption," Nature Photon., in press (Oct. 2022).

[5] A. Münchinger et al., "3D Optomechanical Metamaterials," Mater. Today, in press (2022); https://doi.org/10.1016/j.mattod.2022.08.020.

[6] L. Yang et al., "Laser printed microelectronics," submitted (2022)

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