SYLL 2: Hochleistungslaser und deren Anwendungen II

Zeit: Mittwoch 16:30–18:30 Raum: HS 4

Hauptvortrag SYLL 2.1 Mi 16:30 HS 4

Extreme Licht Infrastruktur - Eine einzigartige EU Laser-Forschungseinrichtung — •Mikhail Kalashnikov — Max-Born-Institut, Berlin Germany

ELI wird eine der größten Forschungseinrichtungen der Europäischen Union sein, wo die weltweit intensivsten Lasern mit kürzesten Pulsen entwickelt und aufgebaut werden. Dies ist die erste Forschungsstruktur in der Welt, um die Wechselwirkung zwischen Licht und Materie bei ultra-relativistischer Lichtintensität zu untersuchen. Ihre Lasersysteme werden neue Möglichkeiten von Laser-Materie-Wechselwirkung eröffnen: Erreichen des höchsten elektromagnetischen Feldes, Beschleunigung der Materie, Elektronen und Ionen zu relativistischen Geschwindigkeiten, Generation von kohärent oder nichtkohärent hochenergetischer Strahlung, Generation von ultra-kurzen Impulsen im atto- bis yocto- Sekunden Bereich. Dies bestimmt, dass ELI eine Vier-Säulen Architektur hat, der Attosekunden Forschungseinrichtung in Ungarn (ELI-ALPS), der höchst Energie Beamline Forschungseinrichtung in Tschechien (ELI-Beamlines), der Kernphysik Forschungseinrichtung in Rumänien (ELI-NP) und einer Höchstfeld Forschungseinrichtung in einem Land, das in nächster Zukunft ausgewählt wird, besteht. Die ELI Forschungseinrichtung wird die erste große wissenschaftliche Infrastruktur sein, welche im östlichen Teil der Europäischen Gemeinschaft beheimatet sein wird und eine anziehende Plattform für die Entwicklung einer neuen Generation von Studenten, Doktoranden, Wissenschaftler und Ingenieure sein.

Hauptvortrag SYLL 2.2 Mi 17:00 HS 4

High Power and High Energy Cryogenic Yb-Lasers for Soft-X-ray Sources — •Franz X. Kaertner — Center for Free-Electron Laser Science, DESY and Physics Dept., University of Hamburg, — Dept. of Electr. Eng. and Computer Science and Research Laboratory of Electronics, MIT

High Harmonic Generation in the soft-X-ray region requires high energy and large average power long wavelength ultrashort pulses to achieve phase matching and counteract the low conversion efficiency of this process. In this presentation, we review our effort in developing suitable large average power, high energy laser sources at 2 micron based on optical parametric chirped pulse amplifiers pumped by cryogenically cooled Yb:YAG lasers. We demonstrate 40-mJ, 10-ps pulse generation at 1kHz repetition rate from a rod-type cryogenically cooled Yb:YAG amplifier chain and propose and analyze a composite-thin-disk laser technology. The advantages of this new technology in terms of power and energy handling as well as suppression of amplified spontaneous emission will be discussed and first experimental results will be presented.

Hauptvortrag SYLL 2.3 Mi 17:30 HS 4

A single frequency laser at 191 nm — •Jürgen Stuhler, Matthias Scholz, Dmitrijs Opalevs, and Wilhelm Kaenders — TOPTICA Photonics AG, Gräfelfing, Germany

We present a cw narrow linewidth deep-UV source at 191 nm, consisting of a grating-stabilized diode laser which is frequency-quadrupled by two consecutive second harmonic generation (SHG) stages.

In the first SHG stage, the fundamental light at 764 nm is resonantly enhanced and frequency doubled to 382 nm in a lithium triborate (LBO) crystal. The resulting uv light is beam shaped and enhanced in the second SHG stage. Using the novel crystal potassium fluoroboratoberyllate (KBBF) [1], an output power of up to 1.3 mW at 191 nm is achieved [2]. The linewidth of the laser output at 191 nm (1570 THz) is estimated to be below 300 kHz (1 km coherence length). Automatic fine tuning of the laser up to 40 GHz and coarse wavelength changes of 1 nm are possible. Similar techniques should provide wavelengths between 165 nm and 205 nm.

The demonstrated light source is a unique tool for deep-UV metrology, photoemission spectroscopy or atomic spectroscopy.

[1] C. Chen et al., "Deep-UV nonlinear optical crystal KBe2BO3F2 - discovery, growth, optical properties and applications", Appl. Phys. B 97, 9-25 (2009).

[2] M. Scholz et al., "A 1.3-mW Tunable and Narrow-Band Continuous-Wave Light Source at 191 nm", OPTICS EXPRESS 20, No. 17, 18659-18664 (2012).

Hauptvortrag SYLL 2.4 Mi 18:00 HS 4

The Innoslab Laser Platform - ns to fs pulse duration at kW class output power — •Dieter Hoffmann, Peter Russbüldt, Marco Höfer, Peter Loosen, and Reinhart Poprawe — Fraunhofer Institut für Lasertechnik, Aachen, Steinbachstraße 15

With the Innoslab concept a new fundamental platform for highly efficient and compact laser oscillators and amplifiers has been developed and continuously improved in the past 15 years. Starting with partially end-pumped lasers with a line-shaped pump cross section in 1996, the continuous performance improvement led to of a series of output power records for short and ultrashort pulsed lasers. For example 120 mJ pulse energy at sub ns pulse duration and 1.3 kHz prf has been demonstrated based on a Nd:YAG MOPA. With a Yb:YAG MOPA more than 1 kW output power at 600 fs pulse duration has been demonstrated. Further power scaling to multi kW level, generation of sub 400 fs pulses and a new Innoslab design of an extremely compact planar geometry are currently in progress. The presentation provides an overview over the most important Innoslab results and gives an outlook on promising next development steps.