Year of light 2015 – the assistance of the laserdiode

MTA Energiatudományi Kutatóközpont Műszaki Fizikai és Anyagtudományi Intézet (MFA)

Budapest, Konkoly Thege Miklós u. 29-33., 26-os épület, 104.

2015. szeptember 24.,8.30-16.30h

ABSTRACTS

" How Cold Atoms paved the way for the Observation of Distant Stars / From the Very Cold and Small to the Ultrafar at TOPTICA" W. Kaenders, TOPTICA-München

Cold atoms research has synergistically led to the development of novel laser tools, in particular tunable diode lasers and fiber combs that are ideally matched to each other. As one would think that such high-end technology requirements for laser-cooling of atoms are unique, given the exquisite lab-bound nature of this research topic, the vastly expanding cold atom field has generated nevertheless enough of a technology surge for the development of other mature laser products. They now find their usage in the other extreme end of current research, namely the latest generation of astronomical telescopes. As cold matter research is trying to unravel secrets of the early universe, also its „laser tooling" has become the backbone for adaptive optics implementation using laser guide stars to cope with the atmospheric issues in the same endeavor of understanding for example star formation.
In the talk I will try to also give an insight into TOPTICA, a customer-oriented and boot-strapping high-tech company, which might inspire other joint technology initiatives in the future.

"Manipulation of trapped rubidium atoms using chirped diode laser pulses" B. Ráczkevi, WIGNER-RMI

Diode lasers are ideal tools for generating resonant light for atoms that have absorption lines at the near infrared spectrum, such is like rubidium. Trapped atoms can be manipulated by laser pulses using stimulated emission and absorption processes. Photon emission and absorption takes place with mechanical momentum transfer from the laser beam to the atomic cloud which could be used for accelerating the whole package without heating the ensemble. An efficient way of accelerating atoms is utilizing frequency modulated laser pulses, simply called chirped pulses. In this case the Doppler shift of the resonance frequency of the moving atoms is always compensated by changing the laser frequency. Chirped frequency light on the RF range can be generated easily by modulating the laser diode current and cut the pulses in the nanosecond time scale by electro optic amplitude modulator. In this talk it will be shown experimental and numerical results as well.

“Versatile quantum dot diode lasers: high-power short-pulse generation, stabilization and interferometry application” S. Breuer, UNI-Darmstadt

The most recent generation of diode lasers are based on nano-scale semiconductor quantum dots (QD) that offer unique properties including ultrafast carrier dynamics, coupled emission states, reduced density of states and broad spectral bandwidth. Based on these particularities, recent advances in the generation and stabilization of sub-picosecond short optical pulses by QD lasers with high pulse peak power as well as continuous-wave emitting QD lasers are discussed with an immediate application potential in nonlinear microscopic imaging, towards time-critical and self-interferometry applications.

"Optical data storage today and tomorrow" P. Koppa, BME-Budapest

The presentation will address recent advances and new challenges of optical data storage. The objectives of high data density, high writing and reading speed and enhanced security pose severe requirements on system architecture, on storage material and on key system components. We will point out how the new approaches modify the needs for new light sources and especially for semiconductor lasers.

“Diode laser based photoacoustics for process control and environmental monitoring applications” Z.Bozóki, UNI-Szeged

In the last 20 years we have successfully developed diode laser based photoacoustic gas concentration measuring systems for various applications including industrial process control and environmental monitoring. For the sake of reliable operation it is critical not only to carefully optimise the operation of the diode lasers during the construction of the analysers but also to ensure that their optimised operation is maintained even during long term automatic operation under harsh conditions. For this purpose various self-checking and correction algorithms were developed especially for achieving the necessary stability of the laser emission wavelength and the accuracy in the laser modulation frequency. The applied methods are reviewed and examples which prove the successfulness of these methods are presented.