FAKULTÄT für PHYSIK
LUDWIG-MAXIMILIANS-UNIVERSITÄT
MÜNCHEN/GARCHING

PHYSIK-DEPARTMENT
TECHNISCHE UNIVERSITÄT MÜNCHEN
MÜNCHEN/GARCHING

MLL-KOLLOQUIUM

Donnerstag, 26.04.2012, 16^{15} Uhr

Hörsaal der LMU in Garching, Am Coulombwall 1
Treffen zum gemeinsamen Kaffee 16 Uhr

Prof. Jörg Schreiber

LMU München

Review of laser ion acceleration and perspectives with LEX and CALA

After more than one decade of successful operation at the Max-Planck-Institute for Quantum Optics, the Advanced Titanium-Sapphire Laser (ATLAS) system has been dismantled and is currently transferred to its new, temporary home, the Laboratory for Extreme Photonics (LEX). This move will allow us to upgrade the peak power from currently 60 TW to 300 TW before it can take on its final upgrade to 3 PW at the Centre for Advanced Laser Applications (CALA), possibly constituting one of the world's most powerful laser systems. The opportunities are manifold. GeV-electron bunches with a few femtoseconds pulse duration will be available routinely and in turn enable for the generation of even shorter light, UV, X- and Gamma-ray pulses. The high laser pulse energy (60 J) paired with the short duration (20 fs) will allow to access light intensities of up to 10^{23}W/cm^2 and address fundamental questions of modern physics. One major prospect, however, is the generation of ion bunches with energies beyond 100 MeV/u, sufficiently high to approach and investigate their applicability in tumour therapy.
In this talk, I will explain various concepts of laser-driven ion acceleration that have been employed and studied over the past years. At present, the application of nanometer thin foils seems to be most promising both in terms of achieving highest energy and conversion efficiency. The demands on the quality and control of the laser pulses, mainly in terms of the suppression of prepulses, are enormous. Despite of these difficulties, we could demonstrate first biological studies with tumour cells irradiated by laser accelerated proton bunches with single shot doses of several Gray in 2011. This demonstration has been a major mile stone of our research. Moreover, the combined efforts in laser, target and detector development disclosed a number of new and partially surprising insights that constitute my excitement for this field of physics and motivate for the future challenges and possibilities that await us.

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