LASER-WAKEFIELD ACCELERATORS AS DRIVERS FOR UNDULATOR-BASED LIGHT SOURCES

M. Fuchs, S. Becker, F.J. Grüner, D. Habs, LMU, München, Germany
S.M. Hooker, University of Oxford, Clarendon Laboratory, Oxford, UK
S. Karsch, F. Krausz, Z. Major, A. Popp, MPQ, Garching, Munich, Germany
J. Osterhoff, LBNL, Berkeley, California, USA
U. Schramm, FZD, Dresden, Germany
R. Weingartner, LMU, Garching, Germany

Abstract

Latest developments in the field of laser-wakefield acceleration (LWFA) have led to relatively stable electron beams in terms of peak energy, charge, pointing and divergence. Electron beams with energies of up to 1 GeV have been produced from only few-centimeters long acceleration distances. Driving undulators with these electron beams holds promise for producing brilliant X-ray sources on the university-laboratory scale. In this talk, we will present an experimental breakthrough on this path: our laser-driven soft-X-ray undulator source. In the second part of the talk, we will discuss the physics behind the unique characteristics of laser-wakefield accelerated electron beams such as the intrinsic ultrashort pulse duration (expected to be about 10 fs) and the low normalized transverse emittances (expected to be < \pi mm\times mrad). The properties of state-of-the-art wakefield accelerators as well as their limits will be discussed. Finally new schemes to overcome those limits and further improve the beam quality will be presented.