AKBP 1: Particle Sources

Time: Monday 15:00–16:00 Location: MOL 213

AKBP 1.1 Mon 15:00 MOL 213

Development of polarized sources with new laser techniques — •Chrysovalantis S. Kannis[1,2], Ralf Engels[1], Anna Hützen[1,3], Lukas Huxold[3], Ilhan Engin[1], Dimitris Sofikitis[4], T. Peter Rakitzis[5,6], Andreas Lehrach[1,2], and Markus Büscher[1,3] — [1]Forschungszentrum, Jülich, Germany — [2]RWTH University, Aachen, Germany — [3]HHU, Düsseldorf, Germany — [4]UOI, Ioannina, Greece — [5]FORTH, Heraklion, Greece — [6]UOC, Heraklion, Greece

Molecular photodissociation and optical pumping are two innovative laser-based techniques for the production of macroscopic spin-polarized samples. The first is used for the production of high density spin-polarized hydrogen and deuterium atoms from UV photodissociation of hydrogen and deuterium halides (e.g. HBr, HCl, DI, etc.). The second is used for the production of nuclear-polarized ^{3}He. After the ionization of the atomic gases, the spin-polarized ion targets are useful for the study of laser-driven plasma acceleration induced by a high-power laser system. Theoretical calculations indicate that laser-induced acceleration of polarized protons/deuterons of kinetic energies up to several GeV is feasible. Another important application is the polarized laser-fusion. Nuclear-spin polarization plays a fundamental role in the dynamics of fusion reactions and it has been shown that the D-T and D-^{3}He reaction cross sections can be increased by ∼50%. This reactivity enhancement has not been observed in plasma, nor has polarized D-D fusion been measured. However, the aforementioned methods can offer the required densities for such experiments.

AKBP 1.2 Mon 15:15 MOL 213

Development of a GaAs-based photo-electron source with cryogenic components — •Tobias Eggert, Joachim Enders, and Yuliya Fritsche — Institut für Kernphysik, TU Darmstadt, Germany

Polarized electron beams can be generated using the internal photoeffect with GaAs as a photocathode. However, a negative-electron-affinity (NEA) coating consisting of a CsO layer, is necessary when using GaAs. This layer limits the operational lifetime as it gets corroded by oxygen and destroyed by ionized residual gas molecules hitting the surface. The latter is called ion back-bombardment (IBB) and one of the main lifetime limiting factors. Improving the vacuum conditions near the cathode surface is expected to reduce IBB and increase the lifetime. At the Photo-CATCH test facility in Darmstadt, an electron source is developed which uses cryocooling of a sub-volume around the cathode. In addition to the sub-volume, the cathode itself gets cooled.

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AKBP 1.3 Mon 15:30 MOL 213

Improved Performance of GaAs photo-cathodes activated by Cs, Li and NF$_3$* — •Maximilian Herbert[1], Joachim Enders[1], Matthew Poelker[2], and Carlos Hernandez-Garcia[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Thomas Jefferson National Accelerator Facility, Newport News, VA, United States of America

Photo-cathodes based on GaAs can be characterized mainly by two parameters: quantum efficiency η and lifetime τ. The former describes the photo-emission efficiency, while the latter is an indicator for the decay of the surface layer required to achieve negative electron affinity (NEA) for GaAs. This layer typically consists of Cs in combination with an oxidant. Previous studies have suggested that the addition of Li to this layer can significantly increase cathode performance by boosting both η and τ. Recently, first lifetime studies of bulk GaAs photo-cathodes activated with Cs, NF$_3$, and Li have been conducted using the photo-electron gun of the Upgraded Injector Test Facility (UITF) at the Thomas Jefferson National Accelerator Facility (JLab), extracting beam currents of up to 100 μA. We will present the results of these measurements as well as planned measurements at the Institut für Kernphysik at Technische Universität Darmstadt.

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AKBP 1.4 Mon 15:45 MOL 213

A novel X-ray source for microbeam radiation therapy — •Christoph Matejcek[2,4], Johanna Winter[1,2,3], Jan Wilkens[2,3], Stefan Bartzsch[1,2], and Kurt Aulenbacher[4,5,6] — [1]Helmholtz Zentrum München GmbH, Neuherberg, Germany — [2]Technische Universität München, School of Medicine und Klinikum rechts der Isar, München, Germany — [3]Technische Universität München, Physik-Department, Garching, Germany — [4]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Mainz, Germany — [5]Helmholtz Institut Mainz, Mainz, Germany — [6]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

Microbeam radiation therapy is a new preclinical concept in radiation oncology. Due to the use of 25 to 100 μm wide and a few 100 μm separated planar x-ray beams, high peak dose values are crucial. Additionally low photon energy of a few 100 keV and high dose rates are demanded to suppress blurring of the dose pattern. To produce such x-rays with a preclinical prototype of a compact microbeam x-ray tube, a new electron source with a fast rotating target for x-ray production is under development. The source will deliver electrons with a kinetic energy of 300 keV and a current of 300 mA on an eccentric 0.05×20 mm^2 focal spot. Transport of these high currents at relative low energy will be challenging concerning space charge forces. Furthermore the realisation of the focal spot, good beam quality, low emittance are major topics. An additional application of the source can be phase contrast imaging. The general design and recent calculations and simulations will be presented.