

Physikalisches Kolloquium

Donnerstag, 05.12.2019, 16:30 Uhr – Hörsaal 5J

Novel target schemes for laser-driven proton acceleration

Dr. Bastian Aurand, Institut für Laser- und Plasmaphysik, HHU

The acceleration of charged particles by super-intense laser-matter interactions has gained a high interest within the last decades. The unique features of the so-called plasma-accelerators, like their compact design, ultra-short particle bursts or high particle-flux compared to conventional accelerators can be a milestone, for example as a diagnostic tool in physics or to simplify applications like hadron therapy. Besides the fundamental research on the different processes used to accelerate particles, more and more effort is taken in the last years to pave the way towards applications using the unique features of those beams.

In this talk, I will present different approaches to improve laser-driven proton acceleration, e.g. towards a higher repetition-rate, better energy stability, less debris production or the shaping of the spatial beam profile. I will start with a brief introduction into the field by comparing conventional particle accelerators to plasma-accelerators and highlight today's state of the art. Discussing the best-studied mechanism, the so-called Target-Normal-Sheath-Acceleration (TNSA) is the base to introduce modifications, like a double laser focus or the effect of improved target geometry. While both schemes are a variation of TNSA, I will identify the general drawbacks of this method and show two alternative approaches using isolated, mass-limited targets. In the first experiment, a controlled droplet formation from a liquid stream is used, resulting in targets which are larger than the laser focus, leading to a hybrid mechanism. Finally, a hydrogen cluster source will be presented, delivering targets which are Coulomb-exploded by the laser. This mechanism is inherently more stable against fluctuations during the laser-matter interaction and allows at the same time a fine-tuning of the particle energy within a wide range.

A comparison of the approaches will summarize the talk along with identifying future tasks and work-packages towards the goal of applicable laser-driven particle accelerators.

Ab 16:00 Uhr Kaffee, Tee und Gebäck im Foyer vor dem Dekanat der Math.-Nat.-Fakultät (Gebäude 25.31. Ebene 00)

**Für die Dozenten der Physik
Prof. Dr. J. Horbach**