CENTRE D'ETUDES NUCLÉAIRES DE BORDEAUX-GRADIGNAN

Jeudi 12 Juin 2014

à

11H00

Un café sera servi à partir de 10h45

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Short-Duration, Low-Bandwidth Neutron Production via Focused Protons using High-Intensity Lasers

Due to their direct interaction with nuclei, neutrons penetrate deep into materials to probe ion properties directly leading unique insights beyond the capability of charged particles and x-rays. However, a major hurdle in the implementation of such a probe is creating a neutron source that is short in time (sub-ns) to allow the observation of ultra-fast phenomena, such as in-situ neutron damage or to probe material properties at extreme conditions (e.g. plasma, warm dense matter). In addition to an ultra-short burst emission at the source, the neutrons must have a relatively narrow spectrum, otherwise the temporal spreading induced by their flight between the source and the medium to be probed will decrease the temporal resolution of the measurement.

An ideal candidate for the generation of sub-ns duration neutron pulses are protons accelerated by high-intensity (10^{20} W/cm^2) short-pulse (sub-ps) lasers, which are driven into a converter (e.g. LiF, Be). However, such protons are broadband in energy and thus rapidly spread in duration. In this work, the energy spread of these protons is reduced using a "laser-driven microlens", where the protons are focused chromatically by the electric fields of a laser-irradiated cylinder. This technique is found to produce a 3 ns (FWHM) neutron source at the LiF converter target at 0.56 m from the initial proton acceleration. Monte-Carlo simulations using MCNP6 are used to reproduce the experimental data and to understand how the neutron pulse duration evolves with time.

Salle des Séminaires du CENBG

Le Haut Vigneau - BP 120 - F-33175 Gradignan Cedex