BRIGHT, LASER-DRIVEN NEUTRON SOURCES AND THEIR POTENTIAL FOR APPLICATIONS

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Short-pulse laser-driven neutron sources have become a topic of interest since their brightness and yield have recently increased by orders of magnitude. Using novel target designs, high contrast - high power lasers and compact converter/moderator setups, these neutron sources have finally reached intensities that suit interesting applications.

Based on the results of recent experimental campaigns on the GSI PHELIX and the LANL Trident lasers, where we produced an unprecedented neutron flux, mapped the spatial distribution of the neutron production, as well as its energy spectra, we discuss in this paper a path forward to use short-pulsed laser driven neutron sources for various applications. Specifically, we propose a path forward for applications for non-destructive testing, radiography and nuclear safeguard applications based on first measurements for the conversion of energetic neutrons into short epithermal and thermal neutron pulses.

We believe that this path addresses the needs of a large research community by paving the way to use short-pulsed lasers as a source of neutron and hard x-ray. It can open up neutron research to a broad area of applications based on potentially compact and mobile sources for the use in testing and inspection systems. We have done an initial demonstration of active interrogation of sensitive nuclear material with laser-driven neutron beams, and evaluated isotope identification by neutron resonance spectroscopy with those sources. Future laser systems with high average power could complement or even replace large scale facilities like reactors or particle accelerators.