

Laser wakefield accelerators as tools for studying extreme conditions

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Wakefield accelerators driven by intense laser pulses can now produce GeV electron bunches and broadband multi-keV X-rays with femtosecond durations. By using the multiple-beam capabilities available at typical high-intensity laser facilities, these beams are potentially useful tools for exploring extreme conditions that are found in astrophysical environments and can be created in highly transient experiments in the laboratory. Conditions that can be studied the high temperatures and pressures in planetary and stellar interiors, the high X-ray flux found in the vicinity of accretion disks around black holes, and even the intense electromagnetic fields on the surface of quasars. This talk will describe some recent and planned experiments that use laser wakefield accelerators to probe a diverse range of physics including: radiation reaction physics at high intensity, electron-positron pair production in high-flux X-ray fields, time resolved X-ray imaging of high-density shocks and time resolved X-ray absorption spectroscopy of warm dense matter.