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Proton acceleration in laser-driven megatesla magnetic fields[1]

ALEXEY AREFIEV, Univ of California - San Diego, S. S. BULANOV, LBNL, T. TONCIAN, HZDR, Germany — The next generation of laser facilities will make it possible to access laser intensities well beyond 10^{22} Wcm^2. At these intensities, a laser pulse would rapidly energize electrons, making them ultra-relativistic and rendering an otherwise opaque solid material transparent. This phenomenon of relativistically-induced transparency enables a volumetric interaction between the intense laser pulse and the irradiated solid-density matter. Recent 3D simulations of this regime have demonstrated that a laser pulse can drive an unprecedented quasi-static MT-level magnetic field inside the solid-density material [Stark, Toncian, Arefiev, PRL 116, 185003 (2016)]. This talk will present a novel regime for ion acceleration enabled by the MT-level magnetic field. If the laser pulse is able to burn through a massive target, then the electrons exiting the target with the laser pulse generate a field structure that produces dense mono-energetic proton bunches (20 nC in charge and 250 MeV in energy) by an acceleration mechanism not encountered before in experimental and analytical studies [S. S. Bulanov et al. PoP 23, 056703 (2016)].

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