Large intensities of MeV particles and strong charge ejections from laser-induced fusion in ultra-dense deuterium

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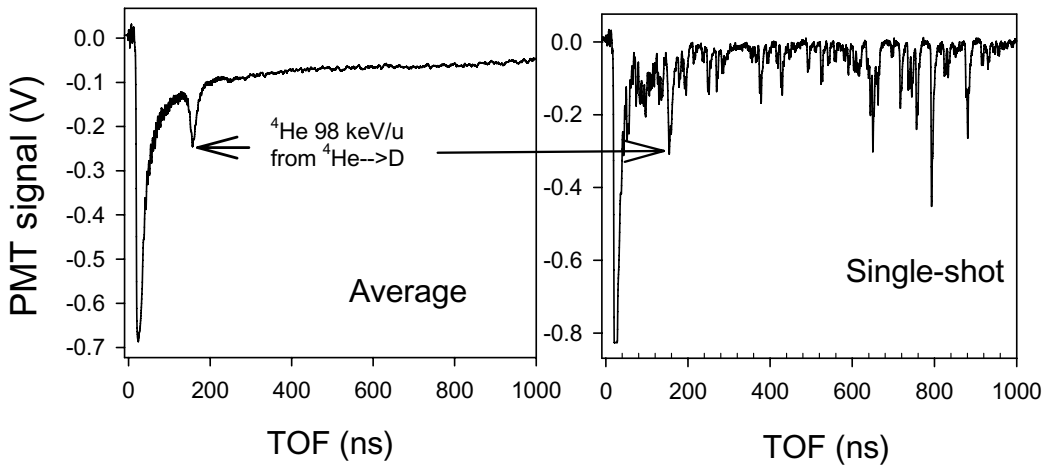
Ultra-dense deuterium D(-1) is a quantum fluid which is both superfluid and superconductive at room temperature. Laser-induced nuclear fusion D+D in D(-1) has been reported previously [1-3]. Due to the large density of D(-1) at 10^{29} cm^{-3}, most MeV particles released are collisionally quenched. Even neutrons with 14 MeV from the fusion processes have a calculated mean free path in D(-1) of only 150 nm [3]. Fast neutron detection is thus probably not useful at energy levels below ignition. High-energy particles initiating the fusion processes are released in the D(-1) layer by Coulomb explosions (keV particles) [4] and laser-initiated self-compression (MeV particles) [5]. Most previous studies have used 0.9 J, 7 ns laser pulses. We now describe the results found employing a laser with 1 J, 80 ps pulses at 1064 nm. A fast plastic scintillator measures the time-of-flight of ejected MeV charged particles, an IR diode observes the IR emission, and antennas and current loops observe charged particle ejections from the fusion plasma. Large intensities of MeV particles from D(-1) are observed. Special effects due to the superfluid state of D(-1) are noted.



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