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Proton Beams from Nanotube Accelerator MASAKATSU MURAKAMI, Institute of Laser Engineering, Osaka University, MOTOHIKO TANAKA, Department of Engineering, Chubu University — A carbon nanotube (CNT) is known to have extraordinary material and mechanical properties. Here we propose a novel ion acceleration scheme with nanometer-size CNT working at such an extreme circumstance as temperatures higher than billions of degree and durations shorter than tens of femtosecond, dubbed as nanotube accelerator, with which quasimonoenergetic and collimated MeV-order proton beams are generated. In nanotube accelerators, CNTs with fragments of a hydrogen compound embedded inside are irradiated by an ultrashort ultraintense laser. Under such laser and target conditions, low-Z materials such as hydrogen and carbon will be fully ionized. Substantial amount of electrons of the system are then blown off by the brutal laser electric field within only a few laser cycles. This leads to a new type of ion acceleration, in which the nanotube and embedded materials play the roles of a gun barrel and bullets, respectively, to produce highly collimated and quasimonoenergetic proton beams. Three-dimensional particle simulations, that take all the two-body Coulomb interactions into account, demonstrate generation of quasimonoenergetic 1.5-MeV proton beams under a super-intense electrostatic field $\sim 10^{14}$ V m^{-1}.

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