Electron Acceleration Using Hollow Fiber with Table Top Terawatt Laser

YOSHIO MIZUTA, KIMINORI KONDO, CHEN ZHENGLIN, TAKASHI NAKABAYASHI, NOBUHIKO NAKANII, RYOSUKE KODAMA, KUNIOKI MIMA, KAZUO TANAKA, GRADUATE SCHOOL OF ENGINEERING, OSAKA UNIVERSITY COLLABORATION, INSTITUTE OF LASER ENGINEERING, OSAKA UNIVERSITY COLLABORATION — A table top laser system can produce over 10TW laser pulse in present. If we focus these optical pulses to $\mu$m size, the focused intensity can be relativistic for electrons. In such a high field, the electron plasma wave (EPW) can be excited. This EPW is attractive for the accelerating field for charged particles. However, the effective interaction length is only a few hundred micro meters. For GeV electron acceleration, this short interaction length should be overcome. A simple hollow fiber is used for obtaining a longer acceleration distance. The spot diameter and the length of focused area should be 10$\mu$m and 10mm, respectively. We used the hollow fiber which has 20$\mu$m inner diameter and 10mm length. To fill the fiber with enough density atoms with keeping a good vacuum condition, the differential pumping system was used. Presently, we have succeeded in injecting $\mu$J femtosecond pulses into the fine hollow fiber in the atmosphere. In this propagation, a strong self phase modulation occurred to generate a white light. Our plan for coming experiment and possible limiting factors will be discussed.

Yoshio Mizuta
Institute Laser Engineering Osaka University

Date submitted: 23 Jul 2008