Recent Progress in Muon Science; Fusion Energy and Industrial Homeland Security Application

KANETADA NAGAMINE

(1) Recently, unexpected phenomenon were discovered in muon catalyzed fusion experiment on D-T mixture: i) Anomalous $\mu^-$ regeneration from the stuck ($\alpha\mu$)$^+$ after the $\mu$CF in condensed D-T mixture suggesting an enhanced regeneration and reduced muon sticking in high-T condensed D-T; ii) Sensitive dependence of (dd$\mu$) molecular formation on the ortho/para-state controlled D$_2$ suggesting an enhanced (dt$\mu$) formation in D-T mixture. Now, a clear future is seen for a realization of break-even. (2) By using the detection system of the near-horizontal cosmic-ray muon radiography originally developed for probing volcanic mountains, measurements were conducted to probe the inner structure of a blast furnace. The thickness of the brickwork was measured, yielding a crucial information for predicting the lifetime of the furnace. By extending muon radiography method using a compact accelerator system, a quick and element-selective detection of hidden special nuclear materials will become possible.