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Development of LBO glass scintillator for high-counting rate neutron detection for the NOPTREX experiment

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"The NOPTREX collaboration is planning to search for time-reversal symmetry violation(T-violation) in nucleon-nucleon interaction at J-PARC. The search for T-violation involves measuring the T-odd cross-section between polarized neutrons and polarized nuclei. For highly-sensitive T-violation search, we require neutron detectors capable of operating under high flux conditions without degradation in performance. At J-PARC, where the T-violation experiment will be conducted, the neutron flux can reach up to Gcps, and γ-ray background is also present.
^{6}Li-glass scintillator is a strong candidate as a neutron detector. It has a light emission time constant of approximately 70 ns. Additionally a thickness of at least 1 cm is required to achieve sufficient neutron absorption for T-violation search, which in turn increases sensitivity to γ-ray background.
We propose LBO glass as a new scintillator, composed of B_2O_3 and Li_2O doped with CeO_2. This scintillator has several features: a faster light emission time constant of 5 ns and 40 ns, and larger neutron absorption cross section and effective detection with a reduced thickness of 1 mm with natural abundance of ^{6}Li and ^{1}0B, which also reduces γ-ray sensitivity. The light output of the LBO glass scintillator is about 10\% of that of the ^{6}Li-glass scintillator. Furthermore, LBO glass scintillator with low or zero CeO_2 concentration may eliminate the 40 ns slow component and exhibit lower sensitivity to γ-rays.
We are evaluating the properties of LBO glass scintillator using α-ray at Nagoya University. In addition, we fabricated LBO glass without Ce and measured light emission time constant at Saitama University. In this presentation, we report the detailed status of these developments."

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