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Launch and operation of the PIKACHU experiment to search for double beta decay in 160Gd

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Gadolinium-160 (^{160}Gd) is a candidate for double beta decay with relatively high natural abundance (21.9%). However, its low Q-value (1.73 MeV) makes the observation of even the two-neutrino double beta decay ($2\nu2\beta$) extremely challenging. Previous experiments using a 2-inch Gd_2SiO_5 (GSO) scintillator couldn't detect $2\nu2\beta$ due to significant background from intrinsic uranium and thorium series in GSO. As a result, the search established a lower limit of 1.9×10^{19} years on the $2\nu2\beta$ half-life. Meanwhile, a theoretical prediction suggests a $2\nu2\beta$ half-life of approximately 7.4×10^{20} years.
The PIKACHU experiment is designed to overcome the limitations by employing large $Gd_2Ga_3Al_2O_{12}$ (GAGG) single crystals and to observe $2\nu2\beta$. GAGG offers several advantages over GSO: higher light yield, possibility of pulse shape discrimination, and a higher ^{160}Gd content by increasing in size. We planned two phases: Phase 1 aims to update the current lower limit on the $2\nu2\beta$ half-life, and Phase 2 is intended to achieve a sensitivity approximately an order of magnitude better than previous study, with the goal of observing the decay.
In this presentation, I will introduce the PIKACHU experiment, present on the development of high-purity GAGG crystals, and report the current status of data acquisition and analysis for Phase 1.

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