

Preliminary Research on Potassium-40 Geoneutrinos Detection Based on Directional Measurement

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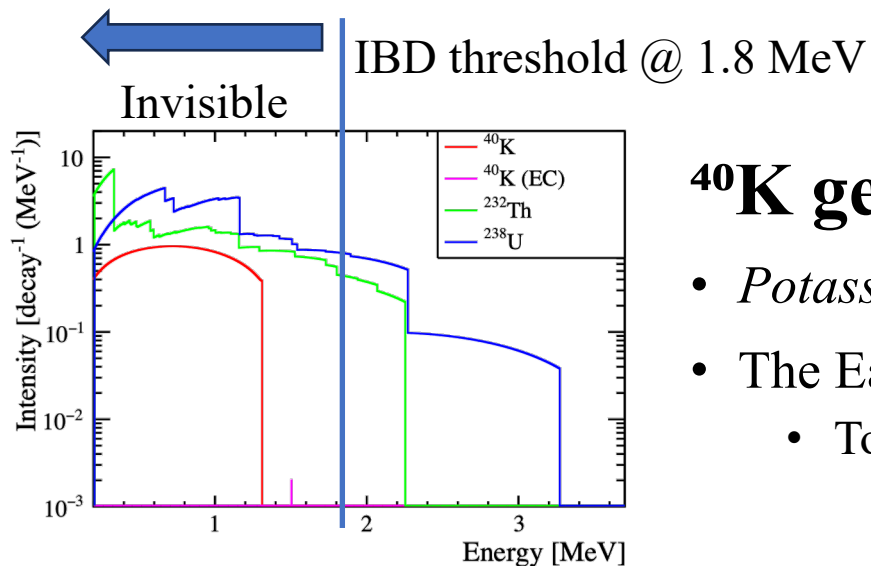
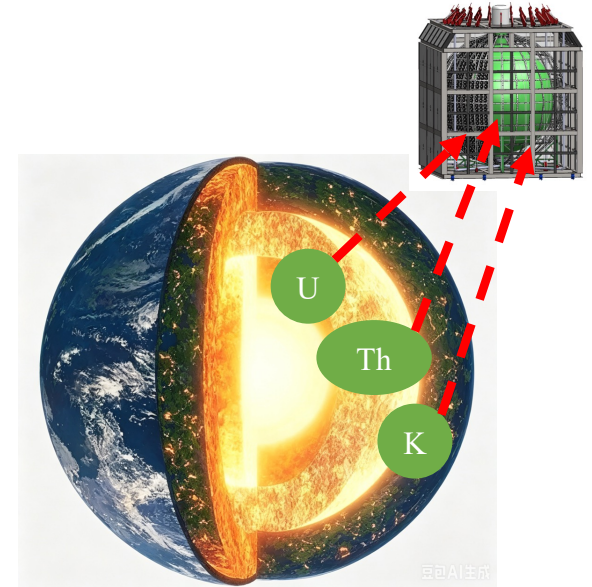
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Why K-40 Geoneutrinos matter

Geoneutrino: Probe of the Earth's deep interior

- Neutrinos emitted from the decay of radioactive elements (U, Th, K...) inside the Earth
- Constraining the Earth's radiogenic heat budget, testing fundamental Earth formation models, revealing mantle dynamics...



^{40}K geoneutrino: not detected yet

- *Potassium is the only semi-volatile heat producing element.*
- The Earth show depleted potassium comparing to chondrites.
 - To space or to the core? $\leftarrow$ ^{40}K geoneutrino detection may answer this.

Detection Method

- **Detection via $\bar{\nu} - e$ elastic scattering channel**

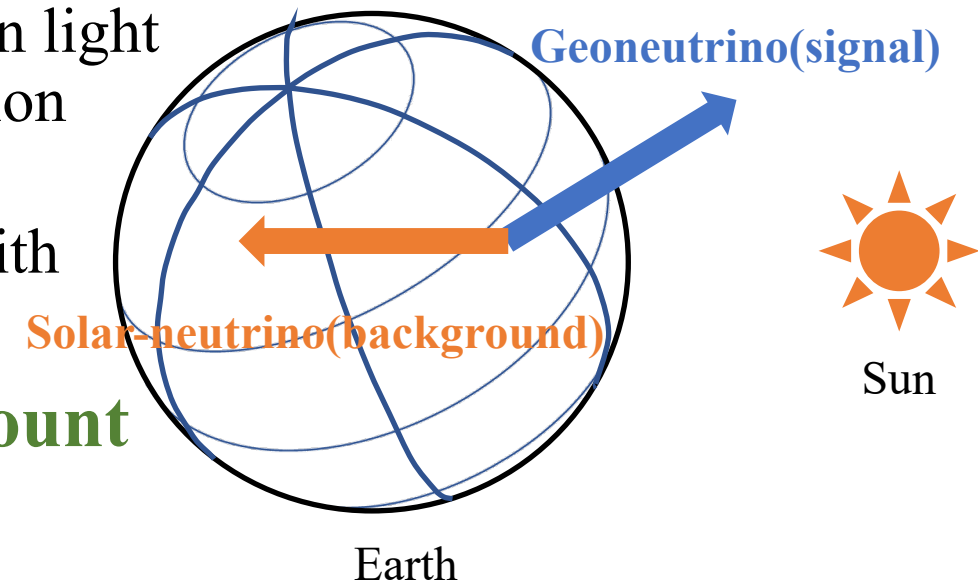
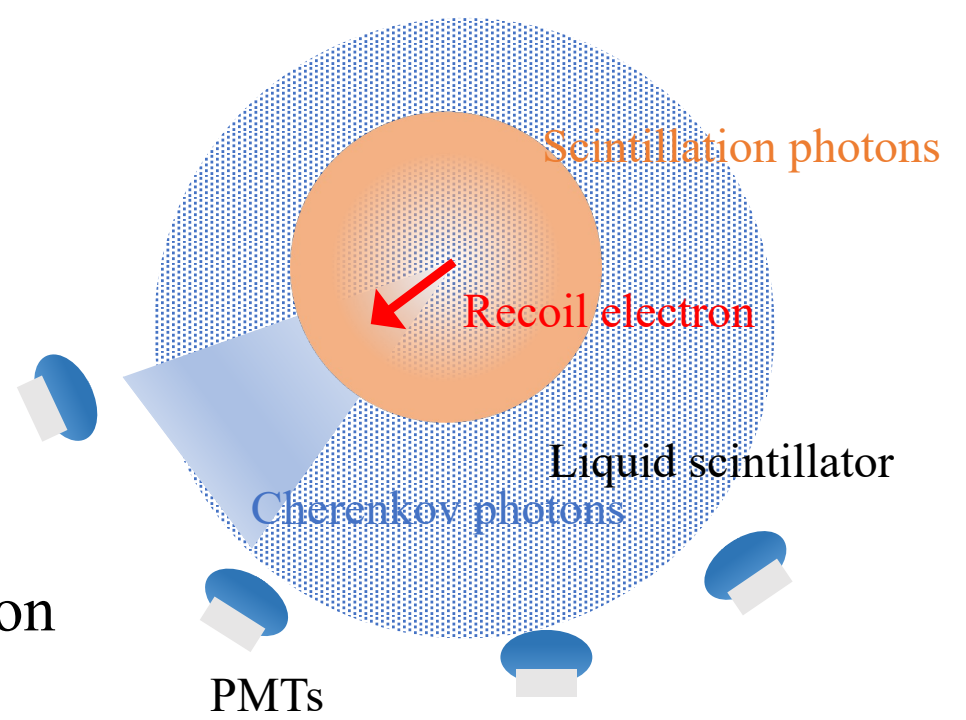
$$\bar{\nu} + e^- \rightarrow \bar{\nu} + e^- \text{ (Signal)}$$

- Very low threshold enables ^{40}K geoneutrinos detection

- **Improve SNR using directional information**

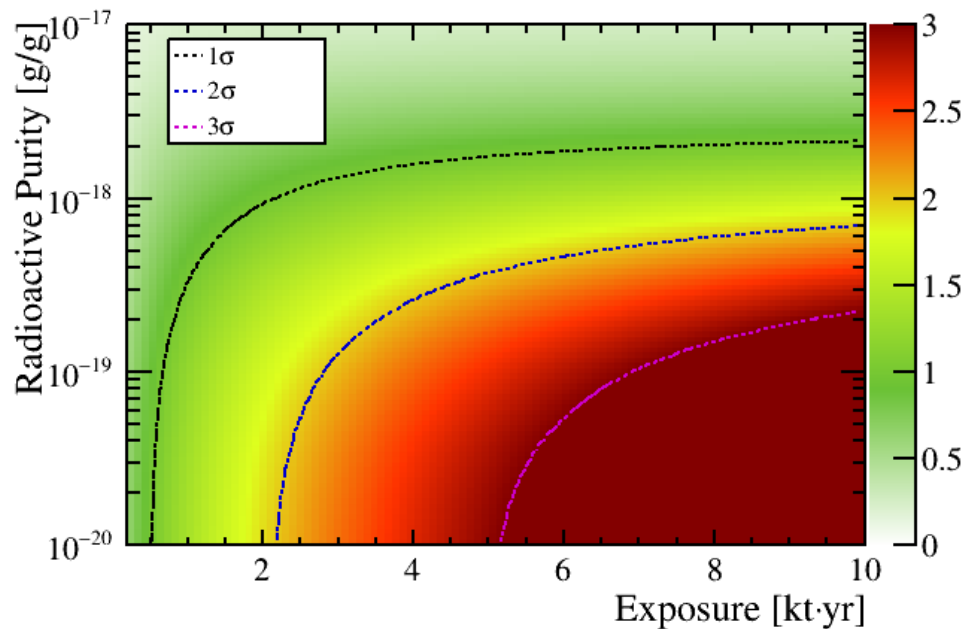
- Employ slow liquid scintillator to separate scintillation light and directional Cherenkov light for energy and direction reconstruction
- Suppress solar neutrino background via correlation with solar direction

- **Radioactive background is also taken into account**



Results Overview

Sensitivity for geoneutrino detection in the 0.7 MeV–1.1 MeV energy region (dominated by ^{40}K geoneutrino signals)



- Radioactive purity exerts a prominent influence on detection sensitivity in range $1.0 \times 10^{-19} \sim 1.0 \times 10^{-17} \text{ g/g}$
 $\rightarrow$ *High-level purification is required*
- Geoneutrinos from U/Th chains still contribute 50% of the total flux in this region
 $\rightarrow$ *High-precision U/Th geoneutrinos measurements are required*

Thanks for listening