LiLAND - Lithium Electron Antineutrino Source at KamLAND

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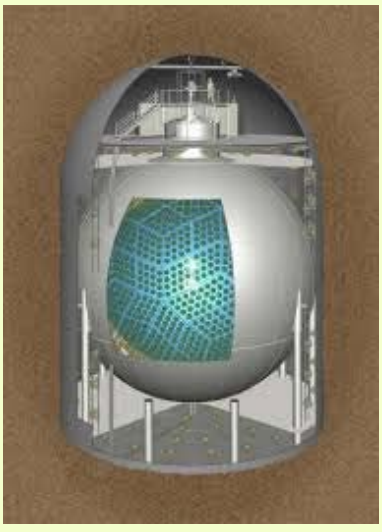
INTRODUCTION

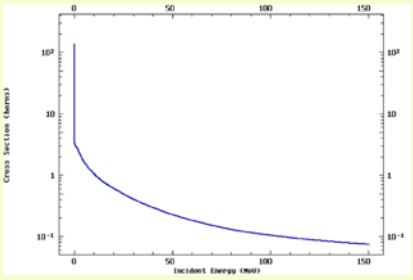
While the three-flavor neutrino standard model seems working fine to explain the data from solar, atmospheric, accelerator and reactor experiments, hint of the fourth flavor of neutrino, the Gallium anomaly in which transition from electron neutrino to sterile neutrino oscillation on the meter scale has been suggested as a solution to measured electron neutrino deficit originally observed in GALLEX and SAGE experiments, and more recently in the BEST experiment in which a four sigma significant deficit of electron neutrinos from the 51-Cr source was measured.



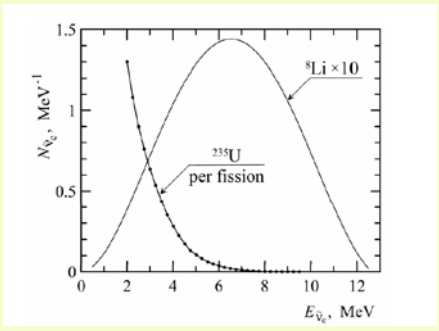
LiLAND experiment proposal is based on a high intensity $\overline{\nu_e}$ source, originating from the β−decay of 8-Li at rest, coupled to KamLAND, a massive scintillator-based detector.
We propose to use DT neutron generator as a source of neutrons required to produce 8-Li and resulting $\overline{\nu_e}$.

Phoenix – high flux neutron generator [1].

The neutron generator utilizes a tritium target to maximize neutron yield and system lifetime, which is measured in years. Mono energetic source, E = 14.5MeV. High neutron yield. Generator yields 1×10 ^{13} to 5×10 ^{13} DT neutrons/s.

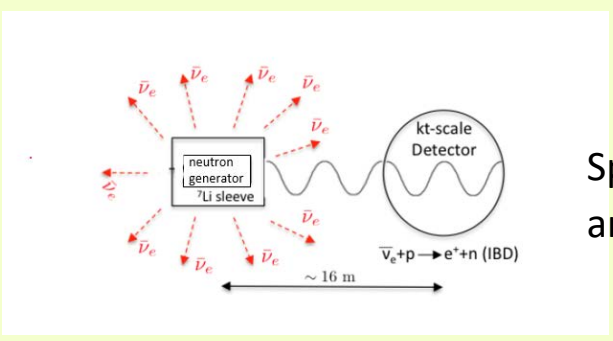


Cross section, elastic scattering of neutrons in heavy water [4].



Spectrum of antineutrinos from β decay of ^8Li and fission fragments of ^{235}U [3].

$$^8Li \rightarrow {}^8Be + e^- + \overline{\nu_e}$$



LiLAND setup

Analysis:
Type and size of moderator:

- Heavy water moderator:
- Li loaded moderator
- FLiBe mixture:

Reflector:

- Volume of graphite and steel
- Sleeve around moderator

References:

1. https://phoenixwi.com/
2. https://arxiv.org/abs/1205.4419
3. https://arxiv.org/abs/1609.02934
4. https://www.nndc.bnl.gov/