A Survey of Low-Energy Inelastic Antineutrino-Nucleus Interactions with Reactor Neutrinos

Summary: There are few existing low-energy antineutrino-nucleus measurements, and limited calculations—with modern advances, it may be time to revisit these interactions, start by surveying materials & detection schemes.

- Why would we want to measure this?
    1. Monitoring reactors—lower thresholds than IBD on hydrogen, higher material density
    2. Search for sterile neutrinos—alternative channel, improved energy resolution, can measure $\bar{\nu}_e$ through CC and ν_x through NC
    3. Testing calculations of nuclear matrix elements
    4. Studying other low energy neutrino sources—geoneutrino, supernovae
    5. Resonant orbital electron capture—enhancement to cross section over narrow energy region, unobserved process predicted by Mikaelyan (1968)
- Very limited existing experimental work
    - ^{37}Cl—Davis (1955), charged-current, unsuccessful.
    - ^{2}H—Jenkins (1969), charged-current. Passierb (1979), neutral-current.
- Limited surveys of materials at reactor ν energies
    - Lee (1978): neutral-current on targets with A < 100
    - Krauss (1984): charged-current on various targets (geoneutrino focus), mention using reactor ν for calibration
- Specific targets others have been interested in:
    - ^{7}Li/^{6}Li: Gerstein (1963), Donnelly (1974/1979/1980), Bernabeu (1979), Seghal (1985), Shul'gina (1993), Wong (2000)
    - ^{10}B/^{11}B: Raghavan (1988), Wong (1998)
    - ^{13}C: Berryman (2019)
    - ^{19}F: Donnelly (1974)
    - ^{23}Na: Seghal (1985)
    - ^{73}Ge: Liao (2008)
    - ^{133}Cs/^{127}I: Wong (1998)
- Goal of LOI is to highlight the need for recent survey of targets, detection schemes, feasibility of detectors to measure these processes
    - Take advantage of advances in computational power, simulations, detector technology, nuclear physics research
- Ideally would follow up with white paper answering these questions, looking S&B for specific detector configurations