

LIDINE 2017 Roundtable Summary

New and Emerging Technologies

New targets, mixtures (H. Lippincott, V. Velan)

- Doping nobles with other nobles offers avenues to new parameter space, but with many challenges/questions. Spoke mainly about Xe-doped Ar and He-doped Xe. Discussed:
 - How does e- lifetime change? Seems to not be a large effect.
 - Mechanism of shifting wavelength; e.g. by doping Ar with Xe, shift to larger wavelength, perhaps easier to detect. We also discussed whether it is feasible to completely eliminate TPB for wavelength shifting and just use doping.
 - Discrimination: immediately after adding LXe to LAr, the discrimination gets worse, but as you add more LXe, the discrimination gets better (although not as good as pure LAr, it appears)
 - We discussed other issues like: electron diffusion, energy resolution, efficiency of electroluminescence in gas
 - Other dopants? “Wish list for doping” is dissolvable in liquid noble, don’t absorb electrons, don’t create high-voltage arcing--minimizes the list of potential dopants.
- Talked about new technologies. Had a summary of using superfluid He-4 with calorimetry for dark matter detection, e.g. low threshold, good discrimination. Use He-3 to tag neutrons?

Bubble chambers, directionality (E. Dahl, J. Watson)

- Directional detection could be a powerful channel for both $0\nu\beta\beta$ decay and dark matter, but difficult to achieve due to short and highly randomized tracks
- Even a small amount of information (parallel or transverse to one direction, head-tail, annual modulation) can lead to large gains in sensitivity when combined with existing channels.
- Serious ideas:
 - cherenkov light(for beta decay)
 - asymmetric superheated droplets
 - liquid crystal bubble chambers, inhomogeneous detector medium/channeling
 - phonon track readout for crystal detectors
 - Heavily photodoped Xe (“bowling ball through ping pong balls”).
- “Out there” ideas:
 - gold foil/dna, nitroglycerin detector, “extremely high gain in one direction.”
 - crowdsourced/government subsidized modular consumer detectors,
 - Dysprosium neutrino capture
- Every idea has some cost (density, area/volume, efficiency, dead time), and the solution may lie in tricking existing technologies rather than developing new ones.
- More realistic for double beta decay than dark matter due to higher energies involved.
- Taking some ideas to the logical extreme started to resemble existing experiments (SuperCDMS and D. McKinsey’s Helium detector).

Novel photodetectors (K. Ni, TJ Whitis)

- Largely discussed the technologies in relation with each other
 - What problems do some technologies have and what research needs to be done to solve them?
- PMTs - Mature technology
 - Higher radioactivity than other technologies
- SiPM
 - QE now near that of PMT's 35-40%
 - Much greater packing factor 73% vs. 40-50% coverage
 - Infrared sensors above 900 nm could be interesting for large Ar TPCs
 - Higher dark count than PMTs
 - Readout challenges with channel number and ganging SiPMs together
 - Long term stability and reliability studies?
 - Afterpulsing or latching under 100k
- Hybrids
 - SiGHT - needs VUV cryogenic photocathode
 - ABALONE - not much information, rumor that production might start soon?

Thank You!