Progress Report on ^{6}LiD and ^{7}LiH for Polarized Targets

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* Products purchased from COGEMA, France
* Irradiations at Saclay Linear Electron Accelerator
* Polarization in
  - SATURNE II target 2.5 T
  - Target for Fermilab 2.5 T
  - Solid St.Physics tgt. 5.0 T

Results:

* **^{6}LiD**: Deuteron polarization **P_d = 0.36** at **2.5 T** in 1 cm^3 after ≈ 5 hours dynamic polarization. $P_{Li} \approx P_d$.

* ^{7}LiH: Proton polarization **P_p = 0.40** at **2.5 T** in 70. cm^3 (5 hrs)
  P_p = 0.80 at **5.0 T** in 0.02 cm^3 (36 hrs)

Projects:

New samples irradiated in May at 5 to 6 times **higher doses** will be tested in the Fermilab target before it leaves Saclay.

Comments:

•The polarizations observed so far are similar to those obtained in very small samples at the same fields by Abragam et al. in 1981. From this one expects that at **6.5 T** the present samples of ^{6}LiD will yield also similar polarizations, i.e., $\mathbf{P_d \approx 0.70}$.

•The energy of the Saclay Linear Accelerator (≈ 200 to 300 MeV) is very appropriate for irradiations.

•Procedures for preparing and irradiating the samples now yield **reproducible results.**

•The tests are closing in on optimal **doses and temperatures** for irradiation.

•From the present knowledge, a **2 liter target volume** of ^{6}LiD will not raise more problems than NH_3 used for the EMC experiment at the CERN-SPS.

* For **inclusive experiments** (no distinction between interactions on protons and on neutrons) ^{6}LiD yields, "all other things equal", the asymmetries with statistical errors **2x less than ND_3**, and **3x less than deuterated butanol** because of its higher average polarization of all nucleons.

* ^{6}LiD is likely to be closer to ***isoscalar nucleon target*** , i. e., closer to equal average polarizations and equal "shadowing" for protons and neutrons, respectively.

*From experiments using deuterated butanol as **polarized neutron target** one has learned how to deal with:

- Target **nucleons not at rest** in the Laboratory Frame (Measure reconstructed Fermi-momentum distributions. Effective target mass differs from free nucleon mass.)

- Relating the nucleon polarization **defined in the nucleon rest frame** to the nuclear polarization defined in the Lab.Frame.

- Dependence of nucleon polarization on **value** and **direction** of Fermi-momentum.

- Experimentally **checking the nuclear physics predictions** relating the average nucleon polarization to the measured nuclear polarization.

Comments (ctd.)

*For the **deuteron,** the **Reid Potential with 6 percent D-wave** contribution works well.

*Elastic meson- and proton scattering on **bound** protons in deuterons has always shown the **same asymmetry** as for similar measurements on **free** proton polarized targets. (Experiments in the range from 1 to 6 GeV/c incident momentum and 0.1 to 2.0 $(GeV/c)^2$ four-momentum transfer, relative precisions of the order of a few percent).

*For **^{6}Li**, similar **tests** can be made for bound protons in ^{6}Li. The nuclear physics predictions for ^{6}Li can be checked, for instance, by measuring asymmetries for **different ratios of D- to ^{6}Li polarizations** . Ideally : produce same polarizations for both, then destroy one. The asymmetry should decrease by exactly a factor of two (if there is no measurable difference in shadowing factors for deuterium and ^{6}Li nuclei for the reaction studied).