Measurement of the longitudinal cross section difference $\Delta\sigma_L$ in polarized n-p scattering at neutron energies of 11-32 MeV

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The strength of the tensor component of the nucleon-nucleon interaction at low energies remains poorly determined. Non-central components are siginificant in few-nucleon systems such as the deuteron and triton. For neutron-proton scattering at low energies the strength of the tensor force is largely characterized by the phase-shift parameter ϵ_1, representative of the mixing between the $^3S_1$ and $^3D_1$ states. Most observables sensitive to ϵ_1 are also sensitive to other phase-shift parameters. By contrast, the difference between the longitudinal and transverse spin-dependent cross sections, $\Delta\sigma_L$ and $\Delta\sigma_T$, is sensitive to ϵ_1 and relatively insensitive to other phase-shift parameters.

Measurements of $\Delta\sigma_T$ have recently been performed at Triangle Universities Nuclear Laboratory for neutron energies 11-32 MeV using transmission of polarized neutrons through a polarized proton target. Measurements of $\Delta\sigma_L$ are now planned at the same energies. A polarized deuteron beam created in the Triangle Universities Nuclear Laboratory atomic beam polarized ion source is accelerated by a tandem Van de Graff accelerator. A beam of polarized neutrons is then produced by the reactions D($\vec{d}$,$\vec{n}$) and T($\vec{d}$,$\vec{n}$). The target is a sample of dynamically polarized protons cooled to 500 mK by a ^{3}He evaporation cryostat and held in a 2.5 T magnetic field. I will describe the experiments and preliminary results.

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