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 significant 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 $\epsilon_1$, representative of the mixing between the $^3S_1$ and $^3D_1$ states. Most observables sensitive to $\epsilon_1$ 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 $\epsilon_1$ 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 $^3\text{H}(\vec{d},\vec{n})$ and $^3\text{H}(\vec{d},\vec{n})$. The target is a sample of dynamically polarized protons cooled to 500 mK by a $^3\text{He}$ evaporation cryostat and held in a 2.5 T magnetic field. I will describe the experiments and preliminary results.