Spin effects in the interaction of antiprotons with the deuteron at low and intermediate energies

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The preparation of an intense beam of polarized antiprotons is *the* crucial point for the physics program proposed by the PAX collaboration [1] at the future FAIR facility in Darmstadt. A possibility to overcome this experimental challenge is seen in scattering of antiprotons off a polarized ^{1}H target in rings [2]. Another possibility is to use the interaction of antiprotons with a polarized deuterium or ^{3}He targets. In addition to the issue of the polarization buildup for antiprotons, $\bar{p}d$ and $\bar{p}\,^3$He scattering are interesting for exploring the spin dependence of the elementary $\bar{p}N$ amplitudes.

Spin-dependent total $\bar{p}d$ cross sections for beam energies of 20-300 MeV were already considered by us in [3] using the optical theorem. For this aim the full spin dependence of the forward amplitude of $\bar{p}d$ scattering was derived. Actual calculations of $\bar{p}d$ observables were performed in the context of the Glauber theory in the single-scattering approximation [3], based on elementary amplitudes of $\bar{p}p$ and $\bar{p}n$ elastic scattering generated from the $\bar{N}N$ interaction model developed by the Jülich Group [4].

In this contribution we present results for $\bar{p}d$ scattering where also double-scattering effects are taken into account [5]. Besides the spin-dependent cross sections, vector and tensor analyzing powers are calculated using, in part, the formalism developed for pd elastic scattering in Ref. [6]. In addition to the $\bar{N}N$ amplitudes predicted by the Jülich model, we utilize $\bar{N}N$ amplitudes from a recent partial-wave analysis of $\bar{p}p$ data [7]. The reliability of the Glauber approximation is examined and it is found that this scheme works very well for $\bar{p}d$ scattering, even at rather low beam energies such as ~ 50 MeV. It turned out that the unpolarized cross sections are insensitive to the employed $\bar{N}N$ amplitudes. On the other hand, and as expected, the predictions for polarized $\bar{p}d$ cross sections vary considerably when using different $\bar{N}N$ amplitudes as input.

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