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Total pbar He-3 and pbar He-4 cross sections at low and intermediate energies

The preparation of an intense beam of polarized antiprotons is
{\it 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 elastic
scattering of antiprotons off a polarized ^{1}H target [2].
Another possibility is to use the interaction of antiprotons with a polarized deuterium
target [3]. As was shown in Ref. [3] on the basis of the Glauber theory with elementary $\{\bar{p}N\}$
amplitudes taken from the J\"ulich models of the $\bar{N}N$ interaction [4], the $\bar{p}\vec{d}$
interaction could provide similar or even more effective polarization of the antiprotons
as the $\bar{p}p$ interaction. This conjecture can be checked at a planned AD
experiment [5]. The next step is to study scattering of antiprotons off a polarized ^{3}He
target. Since the polarization of the ^{3}He is carried mainly by the neutron,
the $\bar{p}n$ amplitudes are expected to dominate the spin observables of this reaction.
In the present work we calculate spin-dependent cross sections
of $\bar{p}\,^3$He interaction on the basis of an approach similar to that developed in Ref.~[3].
In order to check the validity of the Glauber approximation at low energies we calculated
also the $\bar{p}\,^4$He differential cross section at 600 MeV/c beam momentum
and its total annihilation cross section at 200 MeV/c and 600 MeV/c, where data are
available, and found good agreement with the measurements.
The calculated annihilaton cross section for $\bar{p}\,^3$He
is also in agreement with the available data [6] at 200 MeV/c.
The polarization efficiency for $\bar{p}\,^3$He is estimated within the
single-scattering approximation.

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