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POLARIZATION TRANSFER IN DEUTERON BREAK-UP AT 0° MEASURING WITH «ANOMALON» POLARIMETER AT JINR SYNCHROPHASOTRON

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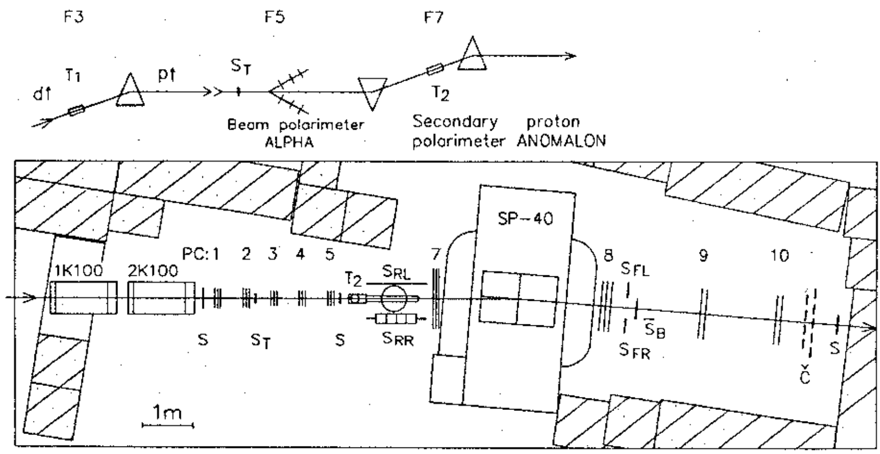
The new experimental results for the polarization transfer in $^{12}C(\vec{d},\vec{p})X$ *at* $0°$ *are presented. The ratio of the proton polarization,* P_p*, to the deuteron beam polarization,* P_d*, æ=* P_p/P_d *has been measured up to the high intradeuteron momentum* $k = 550 MeV/c$*, where intriguing tendency of æ-behaviour can be indicated.*

Previously we reported the results of deuteron spin structure study at short internucleonic distances [1,2] - the polarization transfer was measured at nucleon internal momenta in deuteron $k = 410 MeV/c$ [2]. This result eliminated some phenomenologycal speculations [3] and attracted attention to the theoretical models taking into account final state interaction (FSI) [4]. Recently the polarization transfer at Saclay energies was measured up to $k = 450 MeV/c$ (or $q = 345 MeV/c$ -the proton momentum in the deuteron rest frame) [5]. To advance to the higher k available at JINR Synchrophasotron energies we realized the modification of ANOMALON polarimeter to increase its efficiency [6].

1.EXPERIMENTAL SETUP

The general lay-out of the experiment and the ANOMALON polarimeter is shown in fig.1. The first carbon target T_1 is located in the focus F3 of the extracted deuteron beam. The stripping protons from the projectile deuteron fragmentation at $(0 \pm 1)°$ are transported by $100m$ long beam line to the target T_2 in the focus F7. The analyzing target T_2 is the liquid hydrogen target with a hydrogen recondensation with liquid helium [7]. The *pp*-elastic scattering on the target T_2 is used to analyze a vector polarization of the stripping protons by measuring proton scattering asymmetry at two states of the deuteron beam polarization (up and down) being changed cycle by cycle.



Fiq.1. The general lay-out of the experiment. The high luminosity polarimeter ANOMALON consists of: SP-40 – analyzing magnet with the pole gap of 40cm and the pole sizes of 150x100cm ; PC1-10 – coordinate three-dimensional MWPC detector; S – scintillation beam counters; S_T – 70 m flying path TOF system for p-d identification ; S_{FL}, S_{FR} – left and right forward scintillation counter walls; S_{RL}, S_{RR} – left and right recoil scintillation counter walls; $\bar{S_B}$ – antibeam counters; T_2 – 100 cm long liquid hydrogen target with thin walls (0.12 g/cm) of 55 mm diameter hydrogen vessel.

The using of the time-of-flight analysis is extremely important for polarization transfer measurement at internal nucleon momenta above $400 MeV/c$ because deuteron contamination on the beam line outlet (F7) is comparable or exceeds the proton flux. The proton signal (S_{TOF}) from the TOF separator was used in the fast trigger logic, so the trigger option was:

$$TRIG = (S_{FL} * S_{RR} + S_{FR} * S_{RL}) * \bar{S_B} * S_{TOF} * S_{BEAM}, \qquad (1)$$

where S_{BEAM} is the coincidence signal of the beam counters. At the intensity of polarized deuterons of 10^9 per burst ($0.5s$) and proton internal momenta of $500 - 550 MeV/c$ the rate of a proton scattering events was about $1 - 2$ events per acceleration cycle ($10s$).

2.MEASUREMENTS AND RESULTS

The data taking for measurements of the polarization transfer with the upgraded ANOMALON polarimeter has been performed with polarized deuterons in March 1992, during 200-hour beam run.

The vector polarization of deuteron beam was measured periodically by ALPHA polarimeter [8] and was equal to 0.52 – 0.54. The beam line was tuned to transport the stripping protons with fixed momentum $4.5 GeV/c$ downstream from target T_1. Variation of the proton internal momenta k were achieved by changing projectile deuteron momentum in the range from 9 to $5.8 GeV/c$.

The polarization of protons is given by the following relation, using numbers of events for left and right scattering at up(+) and down(-) deuteron beam polarization:

$$P_p = \frac{1}{A_{pp} < cos\phi >} \frac{\sqrt{N_L^+ * N_R^-} - \sqrt{N_R^+ * N_L^-}}{\sqrt{N_L^+ * N_R^-} + \sqrt{N_R^+ * N_L^-}} \quad . \qquad (2)$$

The $< cos\phi >$ denotes the mean cosine of the azimuthal angle. Analyzing power for pp-elastic scattering, A_{pp}, was calculated according to Spinka et al.[9]. The obtained values for the polarization transfer coefficient æ= P_p/P_d are shown in fig.2.

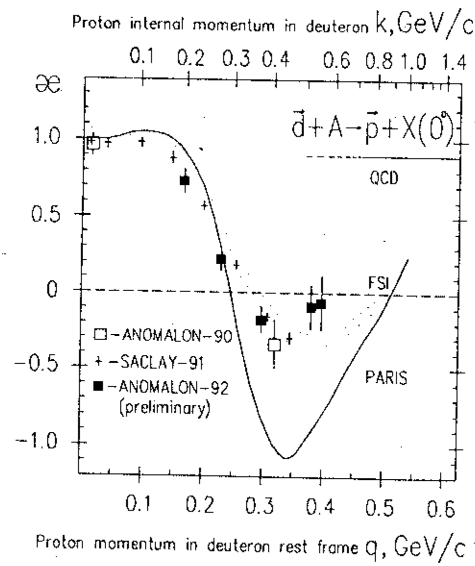


Fig.2. Vector polarization transfer vs. proton momentum k or q. Experimental data: ANOMALON90 - ref.[2], SACLAY91 - [5], ANOMALON92 - these data. Curves: — PARIS IA [4,10], ... FSI (PARIS+FSI) [4], - - — QCD [10].

Up to $k = 400 MeV/c$, in fig.2 one can see good agreement with Saclay data [5] obtained at the deuteron momentum of $3.5 GeV/c$. The data are compared with the impulse approximation (IA) prediction for Paris deuteron wave function and the infinite momentum frame (IMF) calculation, including FSI [4]. Beginning from low internal momenta one can observe a difference between data and the IA prediction, which includes only a spectator diagram. Apparently, the spin observable like æ is very sensitive to rescattering and final state interaction phenomena. Including FSI into calculation in IMF leads to a quite good agreement with data at mean values of internal momenta $k = 250 - 500 MeV/c$.

The last points of our data at $k = 520$ and $550 MeV/c$ demonstrate a change of the æ behaviour, which can point to indication of influence of color cluster configuration in deuteron at high internal momenta [10]. It is very important to advance the æ measurements to higher internal momenta to clarify the further behaviour of the æ(k) and check a very intriguing QCD-prediction for the asymptotic k-behaviour of the deuteron spin structure [10].

Now we are waiting for the next data taking period to continue æ study up to $k = 650 - 700 MeV/c$ and measure the tensor analyzing power T_{20} up to $850 MeV/c$. Further æ measurements will be available at KEK and BNL facilities with the polarized deuteron beam intensities 10^{10} or higher.

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