SPIN EFFECTS IN NUCLEON-NUCLEON ELASTIC SCATTERING

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Three papers involving spin effects in high momentum transfer nucleon-nucleon elastic scattering are briefly summarized.

POLARIZATION IN LARGE ANGLE PROTON-NEUTRON ELASTIC SCATTERING*

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The authors have measured the large angle polarization asymmetry A in the proton-neutron elastic scattering at 2,3, and 6 GeV/c using the polarized proton beam at the Argonne ZGS and a liquid deuterium target. These measurements, the first at high energy, show that A is large (20-40%) and negative at the larger angles, larger and opposite sign to pp scattering, and with no decrease with incident energy, unlike the earlier data at smaller angles. At 90°CM, where A for pp is constrained to be zero because of particle identity, the np asymmetry is increasing with energy, reaching approximately -.3 at 6 GeV/c, in conflict with the basic constituent interchange model which predicts A for np scattering to be 0 at 90°CM.

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SPIN-SPIN FORCES IN 6 GeV/c NEUTRON-PROTON ELASTIC SCATTERING

ENERGY DEPENDENCE OF SPIN-SPIN EFFECTS IN p-p ELASTIC SCATTERING AT 90°CM

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In the two-spin experiment $n\uparrow+p\uparrow\rightarrow n+p$ we measured $d\sigma/dt$ at $P_\perp^2 = 0.8$ and 1.0 $(GeV/c)^2$ at 6 GeV/c. We used the 6 GeV/c 53% polarized neutrons from the 12 GeV/c polarized deuteron beam at the Argonne ZGS, and scattered them from our 75% polarized proton target. Both spins were oriented perpendicular to the scattering plane. We found interesting spin-spin effects in n-p elastic scattering: $A_{nn}=-.17\pm.05$ at $P_\perp^2 = 0.8$, and $A_{nn}=-.19\pm.05$ at $P_\perp^2 = 1.0$ $(GeV/c)^2$. These values are larger in magnitude and opposite in sign from A_{nn} in pp elastic scattering at 6 GeV/c at the same $P_\perp^2$. The basic consitituent interchange model predicts the np A_{nn} to be -.44.

In the two-spin experiment $p\uparrow+p\uparrow\rightarrow p+p$ the energy dependence of the spin-parallel and spin-antiparallel cross-sections at 90^0CM, with spins normal to the scattering plane, was measured for beam momenta between 6 GeV/c and 12.75 GeV/c. The ratio $(d\sigma/dt)_{parallel}$: $(d\sigma/dt)_{antiparallel}$ is about 1.2 up to 8 GeV/c and then increases rapidly to a value of almost 4 near 11 GeV/c (A_{nn} goes from approximately .1 to .6). The highest momenta points suggest that the ratio may reach a limiting value of about 4. When plotted against $P_\perp^2$ this rapid increase in cross section ratio closely matches that observed earlier at the fixed laboratory momentum of 11.75 GeV/c, where the scattering angle was varied. This close correspondence suggests that the pure spin cross sections may be mainly dependent on $P_\perp^2$ in the hard scattering region. The data are in strong disagreement with the basic constituent interchange model, which predicts a cross-section ratio of 2.

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