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 \( n^+p^+\rightarrow n+p \) we measured \( d\sigma/dt \) at \( P^2 = 0.8 \) 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: \( A_{nn} = -0.17 \pm 0.05 \) at \( P^2 = 0.8 \), and \( A_{nn} = -0.19 \pm 0.05 \) at \( P^2 = 1.0 \) (GeV/c)\(^2\). These values are larger in magnitude and opposite in sign from \( A_{pp} \) in \( p-p \) elastic scattering at 6 GeV/c at the same \( P^2 \). The basic constituent interchange model predicts the \( n-p \) \( A_{nn} \) to be \( -0.44 \).

In the two-spin experiment \( p^+p^+\rightarrow p+p \) the energy dependence of the spin-parallel and spin-antiparallel cross-sections at 90°CM, with spins normal to the scattering plane, was measured for beam momenta between 6 GeV/c and 12.75 GeV/c. The ratio \( (d\sigma/dt)_{\text{parallel}}/(d\sigma/dt)_{\text{antiparallel}} \) 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 \( P^2 \) 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 \( P^2 \) 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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