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ON SPIN-SPIN CORRELATION PARAMETER OSCILLATIONS

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Abstract

Troshin S.M., Tyurin N.E. On Spin-Spin Correlation Parameter Oscillations. IHEP Preprint 86-121. - Serpukhov, 1986. - p. 3, fig. 1, refs.: 3.

The model developed previously to describe spin phenomena[1] reproduces the energy dependence of A_{nn} parameter observed at the ZGS and AGS energies and fixed $p_\perp$.

Аннотация

Трошин С.М., Тюрин Н.Е. Об осцилляции параметров спиновой корреляции. Препринт ИФВЭ 86-121. - Серпухов, 1986. - 3 с., 1 рис., библиогр.: 3 назв.

Развитая ранее модель для описания спиновых явлений[1] воспроизводит наблюдаемую энергетическую зависимость параметра A_{nn} при энергиях ZGS и AGS и фиксированном значении $p_\perp$.

In ref.[1] the behaviour of spin-spin correlation parameters A_{nn}, A_{ll}, A_{ss} in proton-proton scattering was considered in the framework of U-matrix quarks model[2]. An oscillating dependence on energy for the parameter A_{nn} and A_{ll} at fixed scattering angle was predicted. A good agreement with the data at $\theta_{c.m.}=90^{o}$ including fast increase of A_{nn} has been obtained. It was also demonstrated that oscillations of $A_{nn}(s, 90^{o})$ and $\frac{d\sigma}{dt}(s, 90^{o})$ have similar nature. The main goal of ref.[1] was to discuss pp-scattering at 90^{o} because there were experimental data at this value of scattering angle.

The model also provides the expressions for spin-spin correlation parameters at arbitrary angles. The interest is connected with the appearance of new data from AGS[3]. It was found the value of $A_{nn}= -2\pm16\%$ at $p_{\perp}^{2}=4.7$ $(GeV/c)^{2}$ and $p_{L}=18.5$ GeV/c. This result along with previous measurements at ZGS support the conclusion on oscillating behaviour of A_{nn} parameter.

The expression for A_{nn} at large angles has the form[11]:

$$A_{nn}(s,\theta)=(1+(\frac{t}{u})^{3/2}+(\frac{u}{t})^{3/2})^{-1}\cdot\{1+\frac{6m_q^2}{(1-k)^2s}[1+\frac{2}{N}(1-\varkappa)]\cdot$$

$$\cdot\cos2\Lambda(s)[(1+(\frac{t}{u})^{3/2}+(\frac{u}{t})^{3/2})^{-1}-\frac{1}{3}(1+2(\frac{t}{u})^{3/2}+2(\frac{u}{t})^{3/2})]+$$

$$+\frac{2}{(1-k)^2N^2s}\sqrt{tu}(t-u)^2(1-\frac{1}{1+(\frac{t}{u})^{3/2}+(\frac{u}{t})^{3/2}})\}\cdot \qquad (1)$$

The corresponding amplitudes are given in ref.[1]. In eq. (1) $m_q=m_u=m_d$ denotes a constituent quark mass, $N=n_1+n_2$ is the total number of valence quarks factor $\varkappa > 1$ accounts for a more central mechanism of helicity flip scattering and k - is the fraction of the hadron energy carried by

valence quarks. The function $\Delta(s) = \phi_f(s) - \phi_o(s)$ is the phase difference of quark helicity flip and non-flip factors, respectively[1].

Use of eq. (1) leads to the value of $A_{nn} = -6\%$ at $p_L = 18.5$ GeV/c and $\theta_{c.m.} = 46^o$, i.e., $p_\perp^2 = 4.7 (GeV/c)^2$. The parameter values in eq. (1) were extracted from the previous description of A_{nn} data at $\theta_{c.m.} = 90^o$[1]. Energy dependence of A_{nn} at fixed $p_\perp$ is shown in figure. When energy continues to grow the parameter A_{nn} in accord with eq. (1) is to change its sign and becames positive at $p_L \simeq 20$ GeV/c.

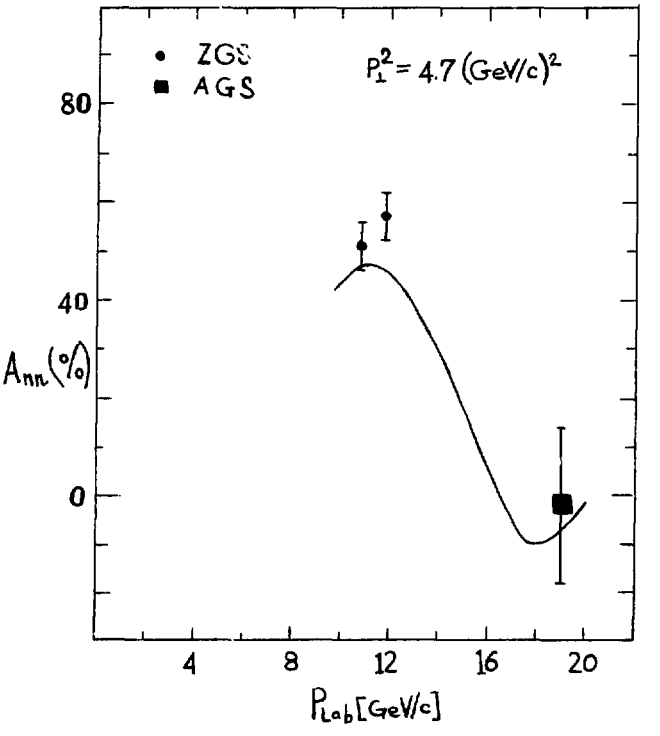

Fig. 1

Such a behaviour of the spin-spin correlation parameter at the ZGS-AGS energy interval and $p_\perp$ fixed is due to both: the fall of A_{nn} when $\theta_{c.m.}$ decreases from the value of 90^o and superimposed oscillations over energy.

These oscillations are of dynamical origin. In the framework of the model they might imply the presence of reso-

nance effects at valence quark scattering. New AGS data reinforce the conclusion that spin effects play an important role in hadron interactions at high energies.

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