Comparison of the fits to data on polarized structure functions and spin asymmetries

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In order to obtain polarized parton densities we make a next to leading order QCD fit using experimental data on the deep inelastic structure function g_1 measured on different nucleon targets. This fit is compared with the updated fit to the corresponding spin asymmetries. We get very similar results for all fits and also for different data samples. The integrated gluon contribution at $Q^2=1\ \mathrm{GeV}^2$ is, as in our previous fits, very small. It seems that only polarized parton densities for the nonstrange quarks Δu and Δd are relatively well determined from the present polarized deep inelastic experiments.

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In order to get polarized parton (i.e., quark and gluon) densities one uses data on deep inelastic scattering of polarized lepton on polarized nucleon targets. Quite a lot of data exist for such scattering. The data come from experiments made at SLAC [1–10], CERN [11–16] and DESY [17,18]. Recently the data from the E155 experiment [10] at SLAC on protons has been published. The experimental groups present data for spin asymmetries as well as for polarized structure functions.

The analysis of the European Muon Collaboration (EMC) group results [11] started an interest in studying such data. Many next to leading (NLO) order QCD analysis [19–26] were performed and polarized parton distributions were determined. The main purpose of this paper is to use data for the polarized structure functions $g_1(x,Q^2)$ on proton, neutron and deuteron targets in order to determine polarized parton distributions. This fit will be compared with our updated (in which we take into account recently published data on protons from E155 [10] experiment in SLAC) fits to spin asymmetries. It was advocated by us [27] and in [19] that by using spin asymmetries for the determination of polarized parton densities one avoids the problem with the higher twist contributions. On the other hand, it is the polarized structure functions and polarized parton distributions that we want to determine.

We compare these two ways of making fits using similar technical assumptions and the same parton functions. We will see that both methods give very similar results for parton distributions. Our previous [25,26] conclusion that the integrated gluon contribution is rather small at $Q^2=1\ \mathrm{GeV}^2$ does not change. Most of the groups used experimental data for spin asymmetries to determine polarized parton distributions. In addition to spin asymmetries one has also experimental data for polarized structure functions calculated from the spin asymmetries in a specific way chosen by an experimental group. There were also several fits to the data on polarized structure functions [20,21]. As in [25,26] we will make fits to two samples of the data. In the first group we will have data for the same x (strictly speaking for the near values) and different Q^2 and in the second the ‘‘averaged’’ data where one averages over Q^2 (the errors are smaller and Q^2 dependence is smeared out). In most of the fits to experimental data only second sample (namely with averaged Q^2 dependence) was used. Our fits use both the sets of data. The data for polarized structure functions are usually given only for averaged sample of data (the exception is E155 experiment for deuteron and proton data).

Experiments on unpolarized targets provide information on the unpolarized quark densities $q(x,Q^2)$ and $G(x,Q^2)$ inside the nucleon. These densities can be expressed in terms of $q^{\pm}(x,Q^2)$ and $G^{\pm}(x,Q^2)$, i.e. densities of quarks and gluons with helicity along or opposite to the helicity of the parent nucleon:

$$q=q^{+}+q^{-},\quad G=G^{+}+G^{-}. \tag{1}$$

q stands for sum of quark and antiquark contributions.

The polarized parton densities, i.e., the differences of q^{+}, q^{-} and G^{+},G^{-} are given by

$$\Delta q=q^{+}-q^{-},\quad \Delta G=G^{+}-G^{-}. \tag{2}$$

We will try to determine $q^{\pm}(x,Q^2)$ and $G^{\pm}(x,Q^2)$; in other words, we will try to connect unpolarized and polarized data.

In our fits we will use functions for the polarized parton densities that are suggested by the fit to unpolarized data [28]. We risk that asymptotic behavior of our parton distributions is not quite correct but it seems to us not so important when we limit ourselves to the measured region of x. Using the functional form of unpolarized parton distributions we can introduce too many parameters and some of them cannot be well determined from the fit. Hence, we use the splitting between valence quarks and sea ones and we include the difference in $\overline{u}$ and $\overline{d}$ densities what could seem artificial when we consider the polarized deep inelastic data only. Our starting point is the formulas for unpolarized quark and gluon distributions obtained (at $Q^2=1\ \mathrm{GeV}^2$) from the fit performed by Martin, Roberts, Stirling, and Thorne (MRST) [28] [they use $\Lambda^{n_f=4}_{(\mathrm{MRST})\overline{\mathrm{MS}}}=0.3$ GeV and $\alpha_s(M_Z^2)=0.120$].

We will not use small and high x behavior of unpolarized parton distributions as fitted parameters as some other groups do. We will split q and G, as was already discussed in Refs. [25,26], into two parts in such a manner that the distributions $q^{\pm}(x,Q^2)$ and $G^{\pm}(x,Q^2)$ remain positive. Our polarized densities for quarks and gluons are parametrized as follows:

$$\begin{aligned}
\Delta u_v(x) &= x^{-0.5911}(1-x)^{3.395}(a_1+a_2\sqrt{x}+a_4x),\\
\Delta d_v(x) &= x^{-0.7118}(1-x)^{3.874}(b_1+b_2\sqrt{x}+b_3x),\\
2\Delta\overline{u}(x) &= 0.4\Delta M(x)-\Delta\delta(x),\\
2\Delta\overline{d}(x) &= 0.4\Delta M(x)+\Delta\delta(x),\\
2\Delta\overline{s}(x) &= 0.2\Delta M_s(x),\\
\Delta G(x) &= x^{-0.0829}(1-x)^{6.587}(d_1+d_2\sqrt{x}+d_3x),
\end{aligned} \tag{3}$$

where in the above formulas for antiquarks (and sea quarks):

$$\begin{aligned}
\Delta M(x) &= x^{-0.7712}(1-x)^{7.808}(c_1+c_2\sqrt{x}),\\
\Delta M_s &= x^{-0.7712}(1-x)^{7.808}(c_{1s}+c_{2s}\sqrt{x}),\\
\Delta\delta(x) &= x^{0.183}(1-x)^{9.808}c_3(1+9.987x\\
&\quad -33.34x^2),
\end{aligned} \tag{4}$$

where the functional form of the last distribution is the same as in the unpolarized case [28].

We also have

$$\begin{aligned}
\Delta u &= \Delta u_v+2\Delta\overline{u},\\
\Delta d &= \Delta d_v+2\Delta\overline{d},\\
\Delta s &= 2\Delta\overline{s},
\end{aligned} \tag{5}$$

and

$$\begin{aligned}
a_3 &= \Delta u-\Delta d,\\
a_8 &= \Delta u+\Delta d-2\Delta s,\\
\Delta\Sigma &= \Delta u+\Delta d+\Delta s.
\end{aligned} \tag{6}$$

We use additional independent parameters (as did before [25,26]) for the strange sea contribution with the same as for nonstrange sea functional dependence. Maybe not all parameters are important in the fit and it could happen that some of the coefficients in Eqs. (3),(4) taken as free parameters in the fit are small or in some sense superfluous. Putting them to zero (or eliminating them) increase χ^2 only a little but makes this quantity smaller per degree of freedom. We will see that that is the case with some parameters introduced in Eqs. (3),(4).

In order to get the unknown parameters in the expressions for polarized quark and gluon distributions [Eqs. (3),(4)] we calculate the spin asymmetries (starting from initial $Q^2=1\ \mathrm{GeV}^2$) for measured values of Q^2 and make a fit to the experimental data on spin asymmetries for proton, neutron, and deuteron targets. The spin asymmetry $A_1(x,Q^2)$ can be expressed via the polarized structure function $g_1(x,Q^2)$ as

$$\begin{aligned}
A_1(x,Q^2) &\cong \frac{(1+\gamma^2)g_1(x,Q^2)}{F_1(x,Q^2)}\\
&= \frac{g_1(x,Q^2)}{F_2(x,Q^2)}[2x(1+R(x,Q^2))],
\end{aligned} \tag{7}$$

where $R=[F_2(1+\gamma^2)-2xF_1]/2xF_1$ whereas F_1 and F_2 are the unpolarized structure functions and $\gamma=2Mx/Q$ (M stands for proton mass). We will use the new value of R determined in [29]. The factor $(1+\gamma^2)$ plays non-negligible role for x and Q^2 values measured in SLAC experiments. In calculating $g_1(x,Q^2)$ and $F_2(x,Q^2)$ in the next to leading order we use procedure described in [25] which follows the method described in [19,30] (one calculates Mellin transforms and then Mellin inverse).

Having calculated the asymmetries according to Eq. (7) for the value of Q^2 obtained in experiments we can make a fit to asymmetries on proton, neutron, and deuteron targets. The other possibility is to use directly the data for the polarized structure function $g_1(x,Q^2)$ (the values of g_1 were given for the averaged values of Q^2) on proton, neutron, and deuteron targets to determine unknown coefficients in expressions for polarized parton distributions. The problem is that different experimental groups used their own specific methods to obtain the values of polarized structure functions $g_1(x,Q^2)$ from the measured asymmetries. At the end we want to know polarized structure functions and polarized parton distributions. In order to calculate them from spin asymmetries we have to choose what we shall take for $F_1(x,Q^2)$ or $F_2(x,Q^2)$ and $R(x,Q^2)$. As was already mentioned we calculated $F_2(x,Q^2)$ in NLO for actual values of x and Q^2 using quark and gluon contributions for $Q^2=1\ \mathrm{GeV}^2$ given by MRST [28]. The values of R were in the earlier fits taken from Whitlow [31] and later from E143 group [29]. We have treated all experiments in the same way. There is also a problem of higher twist corrections (power low corrections to R were included). We will not include the higher twist corrections because of still big experimental errors. The spread of the results could be a measure of uncertainties in both methods. We will compare fits using determination of parameters from polarized structure functions and from spin asymmetries. As will be seen later the results obtained by two methods are very similar.

We have shown in our previous paper [26] that $g_1(x,Q^2)$ calculated from spin asymmetries fits not bad the data points for this structure function. Data points for polarized structure functions were given for averaged data set so it is natural to compare fit to g_1 (called by us fit g) with the fit to spin asymmetries (fit A_1) with the same number of points. We will take into account in this case 197 data points (we will take E155 proton and deuteron data without averaging). These fits will be compared with the fit (fit A_2) to spin asymmetries for nonaveraged data where we take into account 441

TABLE I. The parameters of our three fits calculated at $Q^2=1\ \mathrm{GeV}^2$ together with χ^2 per degree of freedom.

Fit	g	A_1	A_2
a_1	0.61 ± 0.0	0.56 ± 0.13	0.49 ± 0.13
a_2	-7.05 ± 0.23	-5.50 ± 1.22	-5.34 ± 1.20
a_4	17.1 ± 0.23	14.7 ± 1.66	14.66 ± 1.63
b_2	-2.02 ± 0.0	-1.67 ± 0.03	-2.02 ± 0.0
b_3	0.34 ± 0.24	-0.17 ± 0.26	0.35 ± 0.25
c_1	-0.34 ± 0.03	-0.34 ± 0.10	-0.32 ± 0.10
c_2	4.15 ± 0.0	3.23 ± 0.80	3.69 ± 0.79
c_{2s}	4.15 ± 0.0	4.15 ± 0.22	4.15 ± 0.20
c_3	-1.05 ± 0.56	-0.62 ± 0.58	-0.39 ± 0.48
d_2	-29.0 ± 8.6	-15.4 ± 0.22	-14.0 ± 0.04
d_3	87.1 ± 36.1	42.2 ± 15.0	27.0 ± 11.4
χ^2/N_{DF}	0.87	0.81	0.84

experimental data points. At the beginning we will not put any constrains which follow from hyperon decay data. Later we will present the fits where a_8 value (from hyperon decays) will be taken into consideration by adding an experimental point $a_8=0.58\pm0.1$ (the error enhanced to 3σ). That means we will simply add to χ^2 corresponding to experimental points for spin asymmetries the term connected with experimental point from hyperon decays. We will discuss how this additional experimental point influences our results.

Not all parameters are important in the fits. It seems that some of the parameters of the most singular terms are superfluous and we can eliminate them. We will put $d_1=0$ (such assumption gives that $\delta G/G\sim x^{1/2}$ for small x), $b_1=0$ (the most singular term in Δd_v) and assume $c_{1s}=c_1$ (i.e., the most singular terms for strange and nonstrange sea contributions are equal). Fixing these four parameters in the fit practically does not change the value of χ^2 but improves χ^2/N_{DF}. We also have to make some remarks about parameters c_3 and d_2. Specially with the parameter c_3 the situation is a bit complicated. In the first fit for g_1 parameter c_3 is formally essential, i.e., when we eliminate it the value of χ^2 per degree of freedom increases on the other hand in the second fit for g_1 (called later g') this parameter is formally superfluous. That is not the case in fits for spin asymmetries. In this case parameter c_3 is unimportant (i.e. splitting $\bar{u}-\bar{d}$ can not be well determined by data to spin asymmetries). The parameter d_2 is significant in both fits to g_1. We will leave parameters c_3 and d_2 for comparison with fits to g_1 (do not eliminate them) but they could be not well determined and cause some artificial shifts in other parameters.

In Table I we present the values of parameters from the fit to the data on polarized structure functions and spin asymmetries for averaged and nonaveraged data together with χ^2/N_{DF} values.

For the fit to polarized structure functions the obtained quark and gluon distributions lead (for $Q^2=1\ \mathrm{GeV}^2$) to the following integrated (over x) quantities: $\Delta u=0.72$, $\Delta d=-0.64$, $\Delta s=0.05$, $\Delta u_v=0.54$, $\Delta d_v=-0.65$, $2\Delta\bar{u}=0.18$, $2\Delta\bar{d}=0.01$.

We have a positively polarized sea for up and down quarks and a positively polarized sea for strange quarks. The gluon polarization is small. The value of $a_3=1.36$ was not assumed as an input in the fit (as is the case in nearly all fits [22]) and comes out slightly higher than the experimental value. The value of $a_8=-0.01$ is completely different from the experimental figure. Taking into account that fits to polarized structure functions and spin asymmetries use different methods to calculate $F_2(x,Q^2)$ and $R(x,Q^2)$ there is no reason to expect that they give exactly the same results. The obtained values of parameters are very close and practically agree within experimental errors. The parameters calculated in fits to spin asymmetries are closer in comparison to the ones from the fit to g_1 (but are not identical to each other). The spread of parameters measures small differences in the Q^2 evolution, differences in experimental errors and influence of our specific functions used in fits.

As was already mentioned in [25] the asymptotic behavior at small x of our polarized quark distributions is determined by the unpolarized ones and hence do not have the expected theoretically Regge type behavior. Some of the quantities specially integrated sea contributions and also some valence contributions in our fit change rapidly for $x\leqslant0.003$. That is not something that we expect from Regge behavior with small exponent.

Hence, we will present quantities integrated over the region from $x=0.003$ to $x=1$ (it is practically integration over the region which is covered by the experimental data, except

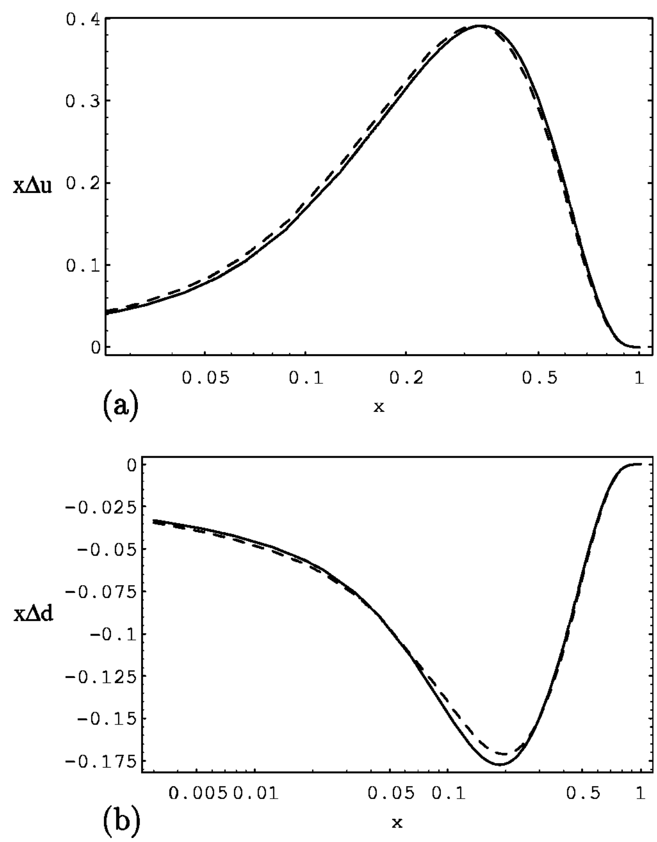

FIG. 1. The quark densities at $Q^2=1\ \mathrm{GeV}^2$ (a) for up quark $x\Delta u(x)$ and (b) for down quark $x\Delta d(x)$ versus x obtained from the fit g (solid line) and A_1 (dashed line).

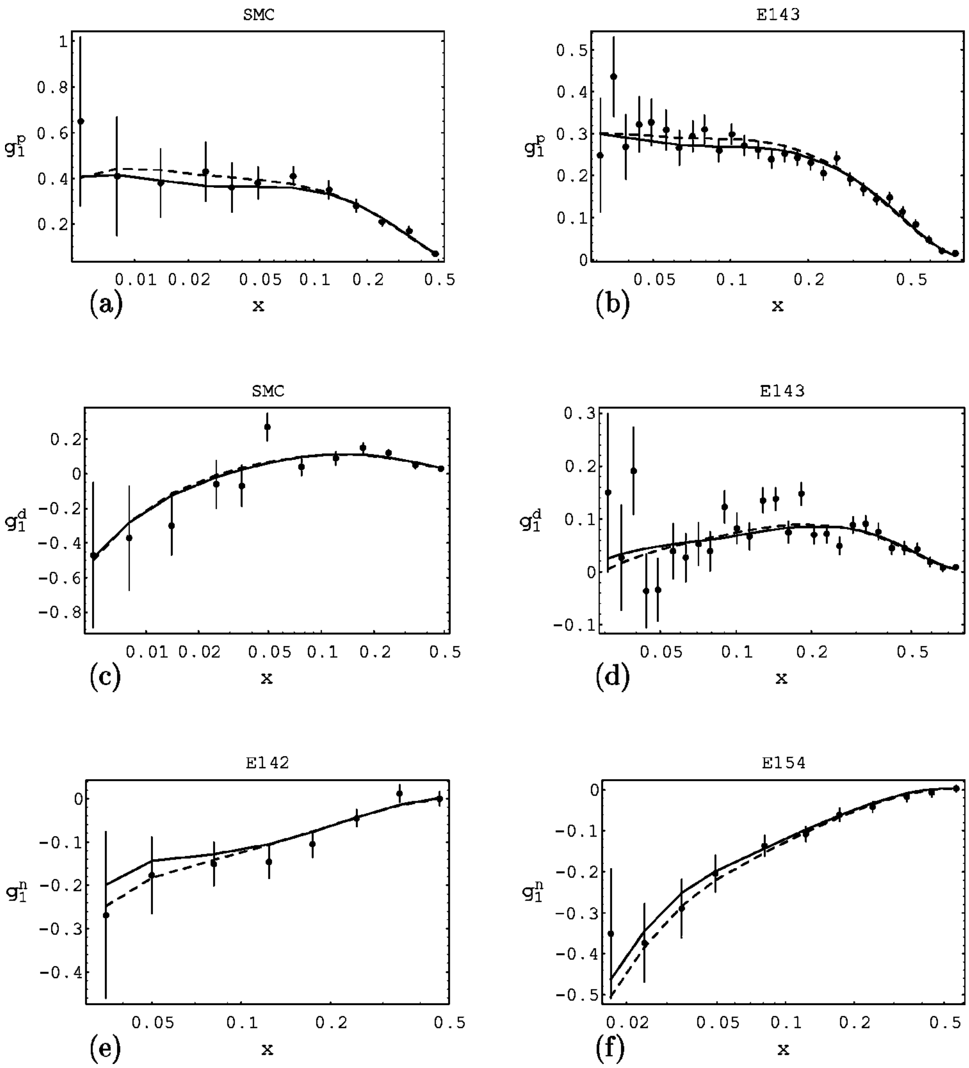

FIG. 2. The comparison of our predictions for $g_1^N(x,Q^2)$ versus x with the measured structure functions in experiments on proton target: (a) SMC [16], (b) E143 [8], on deuteron target (c) SMC [16], (d) E143 [8] and neutron target (e) E142 [3], (f) E154 [6]. Solid curve is obtained from fit g; the dashed one is calculated using the parameters of fit A_1.

of noncontroversial extrapolation for highest x). The values of integrated quantities in the measured region we consider as more reliable than those in the whole region.

The corresponding quantities for three of our fits are presented in Table II.

From the Table II we see that there are changes in valence and sea contributions in different fits but the values of Δu and Δd practically do not differ. We use the parametrization where the most singular term in sea contribution is very similar to valence quark terms and that maybe this is the reason why splitting into valence and sea contribution is fragile and changes for different fits but in the case of Δu and Δd do not differ much. In the first fit we get (at $Q^2=1\ \mathrm{GeV}^2$) $\Gamma_1^p=0.124$, $\Gamma_1^n=-0.052$, $a_3=1.23$ and $\Delta\Sigma=0.36$ comparing with the second fit to averaged spin asymmetries where we have $\Gamma_1^p=0.125$, $\Gamma_1^n=-0.051$, $a_3=1.24$ and $\Delta\Sigma=0.38$. These results are very close. The value of a_3 in the measured region without any assumption comes out close to the value measured in hyperon decays.

TABLE II. The values of quark and gluon polarizations at $Q^2=1\ \mathrm{GeV}^2$ for our three fits.

Fit	Δu	Δd	Δu_v	Δd_v	$2\Delta\overline{u}$	$2\Delta\overline{d}$	$2\Delta\overline{s}$	ΔG
g	0.74	-0.49	0.44	-0.63	0.30	0.14	0.11	0.15
A_1	0.75	-0.48	0.57	-0.57	0.18	0.09	0.11	0.01
A_2	0.76	-0.47	0.54	-0.63	0.22	0.16	0.12	-0.19

For illustration we present in Fig. 1 the distributions Δu and Δd for our sets of parameters calculated from polarized structure functions and the sample of averaged spin asymmetries data. The corresponding values for Δu_v and Δd_v differ much stronger. In our previous paper [26] we already presented how the values of polarized structure functions for proton, deuteron, and neutron calculated from the fits to spin asymmetries compare with the experimental data. To see what is the difference in the values fitted directly to the polarized structure functions and the values calculated from the fit to spin asymmetries we present in Fig. 2 the corresponding curves in comparison with experimental points for g_1^p, g_1^d, and g_1^n at the values of Q^2 in corresponding experiment. As an example we show comparison with experimental points for polarized structure functions g_1^p, g_1^d from SMC from CERN and E143 from SLAC and g_1^n from E142 and

TABLE III. The parameters of three new fits calculated at $Q^2=1\ \mathrm{GeV}^2$.

Fit	a_1	a_2	a_4	b_2	b_3	c_1	c_2	c_{2s}	c_3	d_2	d_3	χ^2/N_{DF}
g'	0.61	-6.84	16.83	-1.86	0.13	-0.31	4.15	-0.54	-1.04	-34.5	102.2	0.88
A_1'	0.56	-5.51	14.73	-1.65	-0.21	-0.34	3.67	-0.63	-0.64	-15.8	43.5	0.80
A_2'	0.50	-5.39	14.72	-1.98	0.29	-0.33	4.15	-0.56	-0.44	-14.2	27.6	0.84

E154 from SLAC. There are some differences but they are not big in comparison with experimental errors. The comparisons for other experimental sets look very similar.

As we already pointed out before we have not made any assumptions about a_8. We obtained from the fits that the value of a_8 is near zero very far from the experimental value and we got positive values for Δs. The value of a_3 that also was not constrained in the fit is close to experimental value (in the measured region of x). In order to make more direct comparison with other fits as before we will also not fix a_8 value but we will add experimental point $a_8=0.58\pm0.1$ with enhanced (to 3σ) error. That means we will simply add to χ^2 corresponding to experimental points for spin asymmetries the term connected with experimental point from hyperon decays. The parameters of our three new fits (called g', A_1', and A_2') are now presented in Table III and results in the region $0.003\leqslant x\leqslant 1$ in Table IV.

There are some small changes in the parameters in comparison to the fits g, A_1,A_2 and the biggest change is in c_{2s} the parameter responsible for the strange sea. Strange quark contribution is not well determined by the polarized deep inelastic data alone and it is easy by additional experimental point on a_8 from hyperon decays to shift the value of a_8 from nearly zero to correct experimental value with only small changes in nonstrange parton parameters. Comparing Table II and Table IV we can see what is the influence of this additional experimental point a_8 on integrated parton densities for our three fits. This additional experimental point causes shifts of integrated parton values. As is seen from Table IV the valence nonstrange quark distributions nearly cancel and the value of $a_8=0.58$ is built up from relatively high sea contributions. The values of Γ_1^p, Γ_1^n, and a_3 do not change in comparison to previous fits. One can easily calculate from Table IV that one has $\Delta\Sigma=0.24$ in the fits g' and A_1'. In our fits the gluon polarization ΔG is small.

In our fitting procedure we actually determine $+$ and $-$ helicity components of parton densities. Polarized quark distributions for up and down quarks as well as strange quarks and gluons for $Q^2=1\ \mathrm{GeV}^2$ are presented in Fig. 3 (we do not present valence and sea contributions separately). They have been gotten from fit g'. We do not present comparison with the densities obtained in fit A_1' because they are very close to those obtained in fit g' (like in Fig. 1). The only difference is for gluons where the shape of the curve is the same but the maximum and minimum of gluon distribution are shifted, gluon distribution coming from fit A_1' is more flat. We can also compare our present fits to spin asymmetries to our previous fits from [26]. Taking into account in the present fits additional data points from E155 proton experiment introduces only not significant changes in quark and gluon distributions calculated from spin asymmetries in comparison with those from [26].

TABLE IV. The values of quark and gluon polarizations at $Q^2=1\ \mathrm{GeV}^2$ for three new fits (where one includes experimental point from hyperon decays).

Fit	Δu	Δd	Δu_v	Δd_v	$2\Delta\overline{u}$	$2\Delta\overline{d}$	$2\Delta\overline{s}$	ΔG
g'	0.79	-0.44	0.47	-0.60	0.32	0.16	-0.11	0.16
A_1'	0.80	-0.44	0.57	-0.57	0.23	0.13	-0.12	0.01
A_2'	0.80	-0.43	0.54	-0.62	0.26	0.19	-0.11	-0.19

However it is not clear whether the general conclusion that the sea contributions for quarks (both nonstrange and strange) are very big (in the measured x region) is correct. It is specific for our model that the leading singularity for polarized quark valence and sea contributions are comparable. That means that splitting into valence and sea contributions could be not well determined in our fits. That of course could be connected with the functional form of polarized parton densities used by us. That means that only Δu and Δd values can be well determined using our parametrization from the polarized deep inelastic data and not valence and sea contributions separately. The value of Δs is determined only by taking into account a_8 value from hyperon decays. The integrated values $\Delta u=0.80$, $\Delta d=-0.44$ are expected since similar values follow from other models. In other fits [19,32] with completely different assumptions for example when one assumes the values of a_3 and a_8 by fixing the parameters of the fitted parton distributions (normalization constants) and with the assumption of $SU(3)$ symmetry for quark sea one gets (using completely different parametrization from that we use for polarized parton densities)

$$\begin{aligned}\Delta u_v-\Delta d_v&=1.26,\\ \Delta u_v+\Delta d_v&=0.58.\end{aligned}\tag{8}$$

It follows that $\Delta u_v=0.92$, $\Delta d_v=-0.34$ and in order to get $\Delta\Sigma=0.20$ [32] we get $2\Delta\overline{u}=2\Delta\overline{d}=2\Delta\overline{s}=-0.13$ and following values $\Delta u=0.79$, $\Delta d=-0.47$ (the values not very different from our values). In such models sea contribution is relatively big and negative contrary to our model where we have at least in the measured region big and positive sea contribution. This type of splitting into big valence and relatively big negative sea contribution is caused by the

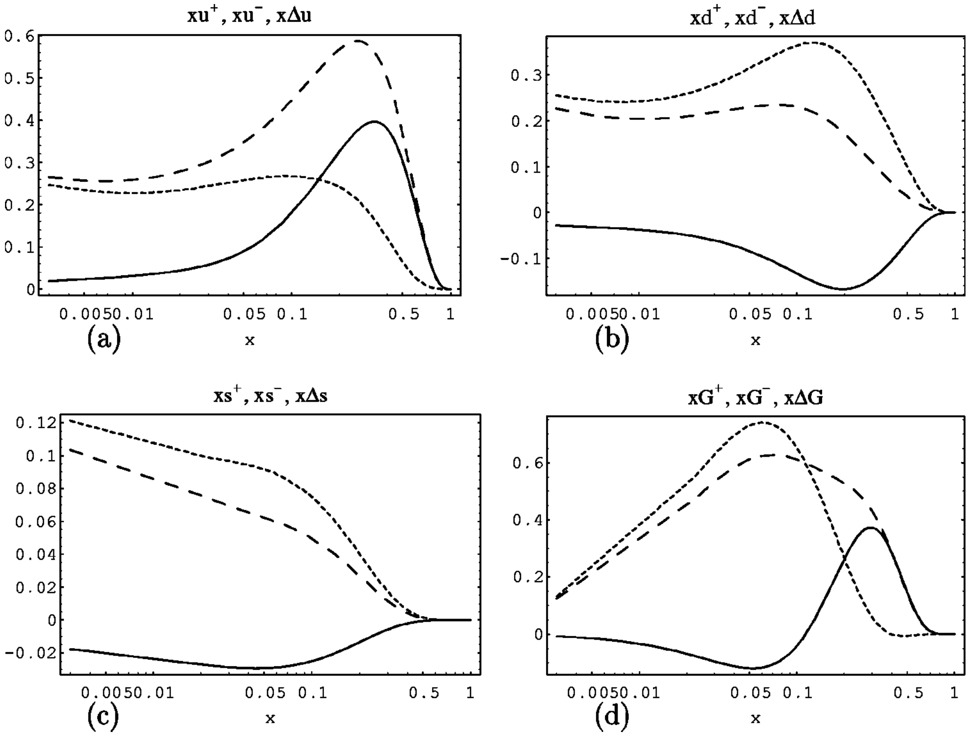

FIG. 3. Our predictions for spin densities versus x for quark and gluons at $Q^2=1$ GeV^2 obtained from the fit g'. We present distributions for u quark (a), d quark (b), sea s quark (c) and gluons (d). For each figure we have densities for partons polarized along $[xq^+(x), xG^+(x)$, dashed lines] and opposite $[xq^-(x)$, $xG^-(x)$, dotted lines] to the helicity of parent proton as well as total polarization of such partons (i.e., the differences of above mentioned quantities, solid lines).

assumptions of the model. We have not made such assumptions taking a_8 as additional experimental point. Our solution with relatively small valence contribution and relatively large positive sea contributions is different but the values of Δu and Δd in both models are very close. It seems that our assumptions are less restrictive. The fact that we can get completely different splitting into valence and sea contributions using the same experimental data shows that this splitting is not well determined by experimental data what is more reliable are distributions of Δu and Δd and their integrated values.

We have made fits to data on polarized structure functions on proton, neutron, and deuteron targets and we have determined polarized parton distributions. These fits are compared with our previous fits for corresponding asymmetries (improved by usage of recent data from E155 proton experiment in SLAC). As a check we also have made fits to spin asymmetries for all (nonaveraged in Q^2) data on spin asymmetries. These fits lead to very similar results with small integrated gluon contribution. The fits were made without inclusion of information on a_3 and a_8 from hyperon decays and then repeated with additional experimental point on a_8. In the first case a_8 is close to zero and Δs is positive. In the second case additional experimental point on a_8 changes practically only parameters of strange quark and causes small shifts in other parameters. The value of a_3 at least in the measured region of x without any assumptions comes out very close to experimental value. It seems that with the parametrization used by us only $\Delta u(x)$ and $\Delta d(x)$ are well determined (not the splitting into valence and sea parts). Polarized strange quark distributions, gluon distributions and also $\bar{u}-\bar{d}$ splitting are not well determined by polarized deep inelastic experimental data.

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