TABLE I. Parameters for the curves in Figs. 1 and 2.

Incident laboratory momentum (GeV/c)	Curve No.	γ	ξ	g_π^2	g_ϵ^2	g_δ^2	$g_{1\rho}^2$	$g_{1\omega}^2$	$g_{1\omega}^2/g_{1\rho}^2$
3.0	1*a*	2.3	0.06	5.2	2.0	1.1	0.20	0.40	2.0
	1*b*	2.3	0.06	5.8	2.2	1.0	0.22	0.18	0.8
	1*c*	2.4	0.05	5.0	1.9	1.0	0.19	0.57	3.0
4.0(*pp*), 4.1(*np*)	2*a*	2.3	0.06	5.8	2.2	1.0	0.22	0.22	1.0
	2*b*	2.3	0.05	3.8	1.47	1.47	0.15	0.85	5.8
	2*c*	2.4	0.05	5.4	2.0	0.92	0.20	0.6	3.0
5.0(*pp*), 5.1(*np*)	3*a*	2.3	0.04	4.1	0.86	0.86	0.27	0.7	2.5
	3*b*	2.4	0.04	4.6	0.0	0.96	0.48	0.48	1.0
	3*c*	2.4	0.04	4.1	0.86	0.86	0.27	0.7	2.5
6.1	4*a*	2.2	0.04	3.94	0.0	0.93	0.27	0.32	1.2
	4*b*	2.3	0.03	4.7	1.0	1.0	0.31	0.22	0.7
	4*c*	2.4	0.04	4.3	0.0	1.6	0.43	0.52	1.2

with too much backward peaking. (b) When ρ and ω contributions are included in the hard amplitude, the effective Pauli-Dirac coupling ratio of the ρ (and also ω) must be chosen very small; otherwise, R is much smaller than the observed value $R\approx 1$. Even then, it is not possible to get a good fit to the angular distributions, and we take this to indicate that there exist important Born contributions other than π, ρ, and ω. (c) The addition of an ϵ and an η contribution to the hard amplitude again tends to decrease R. To fit the data we find it necessary to include the exchange of an isovector, scalar (0^+) state, which we denote as the δ, with a suggested mass at about 960 MeV[8]; we can then fit the ratio R. The angular distributions at the lower energies require, in addition, the inclusion of an isoscalar, scalar meson which we take to be the ϵ at about 700 MeV. It turns out that the results are not sensitive to the parameters of the η exchange; for simplicity, we have here omitted the η and retained just the π, ρ, ω, δ, and ϵ hard exchanges.

The fits to the data[10] are shown in Figs. 1 and 2 and Table I. At lower energies in the range considered, the data can be approximately reproduced by the following ranges of parameters:

$$\gamma=2.2\text{–}2.4,\quad \xi=0.05\text{–}0.06,\quad g_\pi^2=3.8\text{–}6.0,$$
$$g_\delta^2=0.9\text{–}1.5,\quad g_\epsilon^2=1.5\text{–}2.3,\quad g_{1\rho}^2=0.15\text{–}0.2. \tag{3}$$

At the higher energies, somewhat higher values of the ρ coupling and lower values of the ϵ coupling and of ξ are indicated: $g_{1\rho}^2=0.3$–0.5, $g_\epsilon^2=0$–1.0, and $\xi=0.03$–0.04. The large uncertainties in the *np* data prevent a good estimate of $g_{1\omega}^2$. The best fit for $g_{1\omega}^2$ is sensitive to the values chosen for ξ and γ; in most cases, fits can be obtained with $g_{1\omega}^2/g_{1\rho}^2=1.0$–$3.0$.

An important result indicated by these fits is that the soft vector-meson corrections are dominated by ω exchange, for the energies and momentum transfers considered here.[11] It is interesting that the $I=0/I=1$ vector-meson coupling ratio of the Born term is considerably lower than that of the SVNVM. This may be partly due to the situation that the Born part of the *np* charge-exchange amplitude receives a contribution from charged meson exchange, and the SVNVM do not. One may note that our values for the π, ρ, and ω couplings are smaller than those suggested by the low-energy data, an understandable effect which should occur if all vertex structure other than SVNVM exchange is omitted, as above.

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[10] In these fits we have taken the Pauli coupling of the ρ to be negligibly small, for the reasons mentioned above. Owing to the large uncertainties in the *np* data at 7 GeV/c, we have not shown the curves for this energy.

[11] The parameter ξ could not have been determined from *pp* scattering alone. A calculation just completed by H. Goldberg at Northeastern University, using a soft model to fit the new data for single ω production in *NN* scattering, suggests that the SVNVM are principally ω. This is in accord with our results.

Erratum

Simple Relation between Cross Sections for Neutrino Scattering and Total Muon-Capture Rates by Nuclei, JOHN FRAZIER, C. W. KIM, AND MICHAEL RAM [Phys. Rev. D 1, 3168 (1970)]. The research of one of the authors (M. R.) was supported in part by grants from the Research Foundation of the State University of New York and from the National Science Foundation.