be expected to produce a more isotropic Σ^+ distribution even if it could account for the 20-fold discrepancy.

The relationship of baryon magnetic moments obtained by Rubenstein, Scheck, and Socolow,[2]

$$\mu_\Lambda + 3\mu_{\Sigma^+} = (8/3)\mu_p, \qquad (4)$$

is in agreement with the value of the Σ^+ moment.[10] The Λ^0 and Σ^+ moments have a 25 to 30% error, and this does not permit one to distinguish between the above relationship and other theoretical predictions for the hyperon moments.[11]

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ASYMPTOTIC SU(3), SUPERCONVERGENCE, AND THE K_{l3} FORM-FACTOR F_+

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Assuming that in the asymptotic region of large S, the π_{l3} and K_{l3} form factors $f(S)$ and $F_+(S)$ are related by the SU(3) symmetry, a superconvergence relation is suggested, from which, on saturation by the ρ and the K^*, we obtain the approximate result $F_+(0) = -(1/\sqrt{2})M_\rho^2/M_{K^*}^2$.

It has been emphasized by Gell-Mann[1] that a higher symmetry like SU(3), which is evidently broken with the attendent large mass differences within a multiplet, may yet be exact in the asymptotic regions of very large energies and large momentum transfers where finite mass differences do not matter any more. This idea is only just beginning to be useful, as the suggestion has been put forward by Costa and Zimerman[2] that a quantitative formulation of it may be made through statements of superconvergence[3] of such combinations of amplitudes that would vanish if the SU(3) symmetry were to hold exactly. This, of course, can be applied to any other symmetry too.

In this note a simple application of this idea is made to the case of a form factor. Form factors are perhaps even more suited to such a treatment than scattering amplitudes since the spins of the states contributing to the former are much more restricted.

We shall consider the F_+ form factor entering the following matrix element:

$$\langle\pi^0(q')|V_{\mu 3}{}^1(0)|K^+(q)\rangle = (4V^2q_0q_0')^{-1/2} \times[F_+(S)(q+q')_\mu + F_-(S)(q-q')_\mu], \qquad (1)$$

where $V_{\mu 3}^{1}$ is the strangeness-changing vector current and $S=-(q-q')^2$. In the SU(3) limit $(M_K=M_\pi, F_-(S)=0,$ and $F_+(0)=-1/\sqrt{2}$. Let us introduce also the pionic form factor $f(S)$ of the conserved strangeness-preserving vector current $V_{\mu 2}^{1}$:

$$\langle \pi^0(q')|V_{\mu 2}^{1}(0)|\pi^+(q)\rangle = (4V^2 q_0 q_0')^{-1/2} f(S)(q+q')_\mu. \qquad (2)$$

The conserved vector-current hypothesis for $V_{\mu 2}^{1}$ implies that $f(0)=-\sqrt{2}$.

Were the SU(3) symmetry to hold exactly we would have (assuming, of course, that $V_{\mu 3}^{1}$ and $V_{\mu 2}^{1}$ belong to the same octet) $g(S)\equiv f(S) - 2F_+(S)=0$, and $F_-(S)=0$. We assume that $f(S)$ and $F_+(S)$ both satisfy unsubtracted dispersion relations, which are further assumed to be dominated, respectively, by the ρ and the K^* mesons. Now we make the superconvergence assumption that the result $g(S)=0$ holds asymptotically as $S\to\infty$, i.e., the SU(3) symmetry applies only asymptotically. Since $f(S)$ and $F_+(S)$, by assumption, go to zero asymptotically as $1/S$, the last statement suggests that $g(S)$ goes to zero faster than $1/S$. We may then obtain in standard manner the "superconvergence" relation

$$\int_{4M_\pi^2}^{\infty} \mathrm{Im}[f(S)-2F_+(S)]dS=0. \qquad (3)$$

We make the further assumption that, just like the unsubtracted dispersion relations for $f(S)$ and $F_+(S)$, the relation of Eq. (3) is also satisfied by just ρ and the K^* contributions. Treating the ρ and the K^* as narrow, we have

$$\mathrm{Im}f(S)=-\pi/2G_\rho G_{\rho^+\pi^0\pi^+}\delta(S-M_\rho^2), \qquad (4a)$$

$$\mathrm{Im}F_+(S)=-\pi/2G_{K^*}G_{K^{*+}\pi^0K^+}\delta(S-M_{K^*}^2), \qquad (4b)$$

where the G's are defined, for example, by

$$\langle 0|V_{\mu 3}^{1}|K^{*+}(\epsilon,p)\rangle = [G_{K^*}/(2p_0V)^{1/2}]\epsilon_\mu, \qquad (5a)$$

$$\langle K^{*+}(\epsilon,p)|j_{\pi^0}(0)|K^+(q)\rangle = [G_{K^{*+}\pi^0K^+}/(4V^2p_0q_0)^{1/2}](\epsilon^*\cdot q). \qquad (5b)$$

From Eqs. (3), (4a), and (4b) we obtain the result

$$G_\rho G_{\rho^+\pi^0\pi^+} = 2G_{K^*}G_{K^{*+}\pi^0K^+}. \qquad (6)$$

Also from the ρ- and K^*-dominant form of the form factors $f(S)$ and $F_+(S)$, respectively, we have

$$f(0)=-G_\rho G_{\rho^+\pi^0\pi^+}/2M_\rho^2, \qquad (7a)$$

$$F_+(0)=-G_{K^*}G_{K^{*+}\pi^0K^+}/2M_{K^*}^2. \qquad (7b)$$

Enforcing the condition of Eq. (6) on Eqs. (7a) and (7b) and using the conserved vector current value $f(0)=-\sqrt{2}$, we obtain

$$F_+(0)=-(1/\sqrt{2})M_\rho^2/M_{K^*}^2. \qquad (8)$$

Before discussing the result, Eq. (8), we may note that through a similar treatment of the form factor F_- [see Eq. (1)], we shall obtain for the spin-0 combination

$$F_0(S)=F_-(S)+[(M_K^2-M_\pi^2)/S]F_+(S) \qquad (9a)$$

the result

$$\int \mathrm{Im}F_0(S)dS=0. \qquad (10)$$

Equation (10) is not particularly useful at the moment, since we do not know of any pronounced strange scalar states that could be tried for saturating this relation.

Coming back to our result in Eq. (8), we may first note that in the limit $M_\rho=M_{K^*}$, we have $F_+(0)=-1/\sqrt{2}$, which is the well-known result of the SU(3) symmetry. Numerically, the result of Eq. (8), $F_+(0)=-0.51$, would require the rather large Cabibbo factor $\sin\theta_V \simeq 0.3$, rather than $\sin\theta_V=0.22$, to fit the experimental rate for the K_{e3} decay. A better result is perhaps not to be expected, considering that the saturation of the "superconvergence relation," Eq. (3), has been treated very crudely. Saturation of any superconvergence relation by low-lying states has intrinsically a smaller chance of success than the dominance for low energies of an unsubtracted dispersion relation by a few low-lying states, on account of the absence in the former of the weighting effect of the dispersion denominator.[4] Thus, whereas the presence of any, hitherto unknown, vector states ρ', $K^{*\prime}$ at a high mass would have a small effect on $f(0)$ and $F_+(0)$, these could have an effect, in principle, quite comparable with that of the ρ and the K^* on the superconvergence relation Eq. (3). In view of this, we consider the result in Eq. (8) to be quite remarkable.

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LARGE-ANGLE $\bar{p}p$ ELASTIC SCATTERING AT 3.66 GeV/c *

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The $\bar{p}p$ elastic-scattering differential cross section shows a minimum at $t \sim 0.5$ (GeV/c)^2 and a secondary maximum at $t \sim 0.9$ (GeV/c)^2. The total cross section for the annihilation process $\bar{p}+p \rightarrow \pi^- + \pi^+$ is 6.6 ± 3.5 μb; the cross section for $\bar{p}+p \rightarrow K^- + K^+$ is <2.2 μb.

A recent counter experiment[1] which measured the antiproton-proton elastic-scattering cross section at $30° < \theta_{\text{c.m.}} < 90°$ for incident momenta between 1.0 and 2.5 GeV/c clearly demonstrated the presence of a minimum in the differential elastic-scattering cross section at $t \sim 0.4$ (GeV/c)^2. We report on a bubble-chamber measurement of the large-angle elastic $\bar{p}p$ scattering cross section at a laboratory momentum of 3.66 GeV/c. This exposure was taken in the 20-inch Brookhaven National Laboratory (BNL) liquid-hydrogen chamber; the Yale-BNL separated beam was used.[2]

In order to measure the large-angle $\bar{p}p$ elastic scattering distribution and to study the two-meson annihilation reactions $\bar{p}+p \rightarrow \pi^- + \pi^+$ and $\bar{p}+p \rightarrow K^- + K^+$, we conducted a special scan of approximately 50 000 frames of film. The following criteria were imposed on the two-pronged events before these events were accepted for measuring.[3]

(1) To be accepted for measurement the bubble density on the positive prong had to be less than about 5 times the minimum value. In particular, the positive track had to have at least one gap larger than 0.6 mm in space (projected length).

(2) The event had to satisfy the requirements of two-body kinematics in that at least one of the prongs had to have a projected momentum of at least 1700 MeV/c. We also required that the line of flight of the beam antiproton be straddled by the two outgoing tracks.

Our scanned sample contained approximately 20 000 two-pronged events of which we accepted 3800 for measuring. The accepted events were measured and were subsequently processed using the Yale analysis programs. The following three interpretations were considered in the analysis:

$$\bar{p}+p \rightarrow \bar{p}+p, \quad (1)$$

$$\bar{p}+p \rightarrow \pi^- + \pi^+, \quad (2)$$

$$\bar{p}+p \rightarrow K^- + K^+. \quad (3)$$

There were no events found which gave acceptable fits to Reaction (3). Only three events satisfactorily satisfied the kinematics for Reaction (2). And a total of 600 events made acceptable fits to Reaction (1). There were no ambiguities found among Reactions (1), (2), and (3).[4]

At 1.61 GeV/c, Lynch et al.[1] observe cross sections of 119 ± 30 μb and 55 ± 18 μb for Reactions (2) and (3), respectively; our measured cross sections for these final states are 6.6 ± 3.5 μb and <2.2 μb.[5] This surprisingly large difference in the two-meson-annihilation cross sections may be due to contributions from resonant states in the $\bar{p}p$ system at ~2.3 GeV in the center-of-mass system.[6]

To correct our elastic-scattering data for the losses incurred as a result of the scanning criteria, we made the following assumptions: (1) The antiproton beam is unpolarized[2]; we therefore expect an isotropic distribution in the azimuthal angle of the proton about the beam