is defined by Eq. (5), E_f is the true transition energy, and E_B is the binding energy of the muon in the atom. By examining 2^- states ($T=1$) in O^{16} and N^{16}, one gets $\omega f - Ef = 2.56$ MeV.

[15]The form factors in the notation of Ref. 14 are $F_1 = 0.972$, $F_2 = 3.602/2M$, and $F_A = -1.179$.

[16]J. C. Taylor, Phys. Letters 11, 77 (1964), and references given there.

[17]A. B. Migdal and V. A. Khodel, Yadern. Fiz. 2, 28 (1965) [translation: Soviet J. Nucl. Phys. 2, 20 (1966)]; Y. V. Gaponov, Yadern. Fiz. 2, 1002 (1965) [translation: Soviet J. Nucl. Phys. 2, 714 (1966)].

[18]For this normalization, the radius parameter r_0 (i.e., $R = r_0 A^{1/3}$) is $r_0 = 1.25$ F. This comes out from $(1/4\pi)V_0 = 4\epsilon_F r_0^3/9 = (160/9)r_0^3$ with $\epsilon_F = 40$ MeV.

INTERCOMPARISON OF NEUTRON MONITORS DURING SOLAR-FLARE INCREASES

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(Received 1 March 1967)

The energy spectrum of a solar-flare cosmic-ray increase is usually much steeper than that of galactic cosmic rays, and McCracken[1] has pointed out the advantage of using two different absorption lengths for the two components present in a flare increase. This Letter reports a direct measurement of the absorption length of solar energetic particles detected by conventional neutron monitors.

The recent flare of 28 January 1967 has been observed by a superneutron monitor and an IGY-type monitor at Sulphur Mountain (51.20°N, 115.61°W) and by a superneutron monitor at Calgary (51.08°N, 114.09°W). These two stations, at altitudes of 2283 and 1128 m, respectively, have threshold rigidities and asymptotic cones of acceptance which are very similar so that it is possible to determine the absorption length of the solar particles directly.

We have used the relative increases at Sulphur Mountain and Calgary to determine the absorption length of the particles producing the increase with the assumption that the differences intensity observed are a function only of the atmospheric absorption between the two observing altitudes. The normal counting rates of the supermonitors are 10^6/h. Since both galactic and solar components are exponentially absorbed, we may write

$$I_s(\mathrm{Cal}) = I_s(\mathrm{S.M.})\exp(-\alpha\Delta p),$$

$$I_g(\mathrm{Cal}) = I_g(\mathrm{S.M.})\exp(-\beta\Delta p),$$

where I_s and I_g are the intensities of the solar and galactic particles, respectively, and α and β are the respective barometric coefficients. Δp is the pressure differential between the two stations. It is easily shown that

$$\frac{\Delta I_s(\mathrm{S.M.})}{\Delta I_s(\mathrm{Cal})} = \exp[(\alpha-\beta)\Delta p], \tag{1}$$

where ΔI_s, the percentage increase observed, is equal to $(I_0 - I_g)/I_g \times 100$, I_0 being the measured total intensity.

The general cosmic-ray level was relatively undisturbed before and after the flare event, and we have taken I_g to be constant during the event and equal to the average corrected counting rate during the seven hours preceding the event. Using the pressure values during the event, we have subtracted the galactic component from the total intensity at each station to obtain the flare particle intensity as a function of time (Fig. 1). The ratio of percentage increases at the two stations (using the supermonitor data) has been calculated over 20-min intervals. The average ratio $I_s(\mathrm{S.M.})/I_s(\mathrm{Cal})$ between 0900 and 1700 U.T. was 1.26 ± 0.02, and this ratio appears to have remained constant throughout the event. Using Eq. (1) this gives $1/\alpha$ a value of 103 ± 3 g/cm^2 for the absorption length of the solar particles, close to the 100-g/cm^2 value used by McCracken.[1] The absorption length for galactic particles at these stations is 131 g/cm^2. While the value of $1/\alpha$ may vary between events, it is clear that this method enables intercomparison of all stations independent of altitude for each event.

The increase was also measured at Sulphur Mountain with an IGY-type monitor (Fenton, Fenton, and Rose[2]). We have compared the magnitudes of the increases between the two mon-

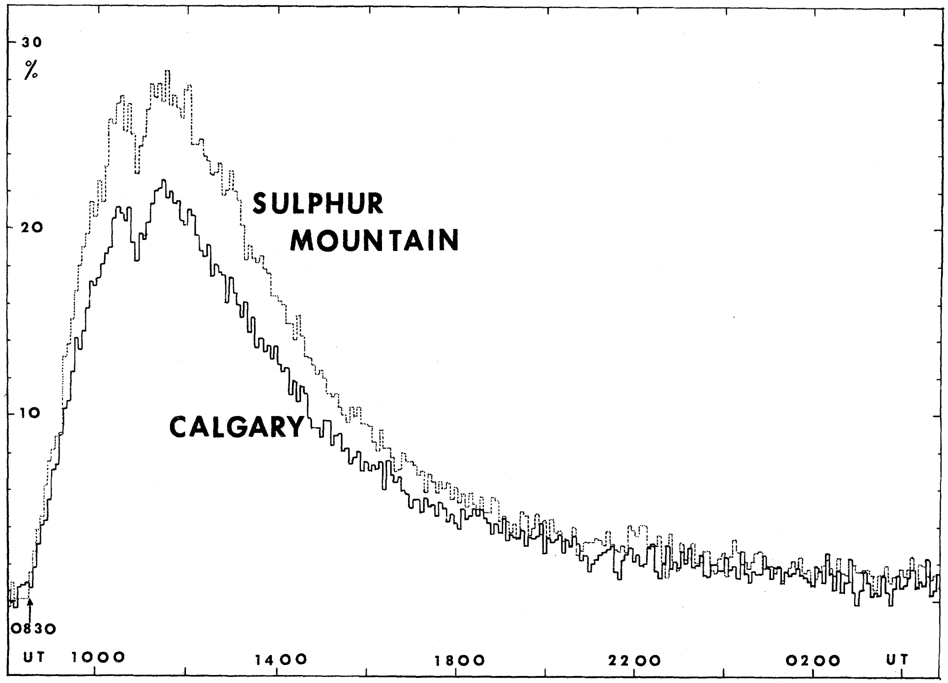

FIG. 1. Solar-flare increase as observed by superneutron monitors at Sulphur Mountain and Calgary (see text).

itors at this station and find the ratio of percentage increase of the supermonitor to that of the IGY monitor to be 1.03 ± 0.05, indicating that the effective responses are very similar. This suggests that the chain of supermonitors can be intercompared directly with the IGY network of stations.

[1]K. G. McCracken, J. Geophys. Res. 67, 423 (1962).
[2]A. G. Fenton, K. B. Fenton, and D. C. Rose, Can. J. Phys. 36, 824 (1958).

ELECTROMAGNETIC CORRECTIONS TO THE WEAK $\Delta S = 0$ VECTOR COUPLING CONSTANT*

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The electromagnetic renormalization of the $\Delta S = 0$ weak vector coupling constant G_V coming from the corrections to the vector part of the weak Hamiltonian is a universal divergent constant, independent of the details of the strong interactions.

An elegant feature of the $V-A$ theory of weak interactions is that the vector part of the $\Delta S = 0$ hadron current is proportional to the isospin current. This assumption, and the hypothesis that the isospin is conserved by the strong interactions, are known jointly as the conserved-vector-current (CVC) hypothesis. An important implication of this view is that the ratios of the renormalized to unrenormalized isovector coupling constants are equal for all processes. When supplemented with the notion of a universal coupling for the isovector current, these conclusions predict simple relations among the observed isovector coupling constants.[1-3]

In order to check the validity of this picture, it is important to calculate the corrections to the vector coupling constants arising from the electromagnetic interactions. The electromagnetic corrections to the decay $\mu \rightarrow e + \nu + \bar{\nu}$ have been calculated to order α.[4-7] Early attempts