found it to be 1.15 $\cos^2\theta$ cm^{-1}, which would give an anisotropy field of about 9×10^3 oersteds. This would correspond to a resonant frequency in the 10^3-kMc/sec range for the mode (4b). If we allow $\vec{H}_0$ to vary with polar angle θ from the [111] axis, (4a) becomes

$$(\omega_1/\gamma)^2 \cong H_0 \sin\theta(H_0 \sin\theta + H_{DM}) + 2H_eH_A', \quad (5)$$

which is the angular dependence observed by Anderson and Kumagai. Kumagai has found the resonance field to vary linearly with frequency. In Fig. 2 we plot ω vs H_0 for $g\approx2$, $H_{DM}\approx1.3\times10^4$ oe, and $2H_eH_A'\approx1.7\times10^7$ (oe)^2. We see that the resonance experiments in $\alpha\mathrm{Fe_2O_3}$ can be rather simply explained in terms of the Dzyaloshinsky-Moriya interaction.

The author would like to express his appreciation to Professor C. Kittel for suggesting this problem and for several valuable discussions concerning its solution. Thanks are also due Professor A. Portis, Professor F. Keffer, and Professor T. Nagamiya for their helpful discussions.

[†] Supported in part by the National Science Foundation.

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OBSERVATION OF A SHORT-LIVED COSMIC-RAY SOLAR FLARE INCREASE WITH A HIGH-COUNTING-RATE MESON DETECTOR*

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(Received June 6, 1960)

We report here observations of a very abrupt and short-lived cosmic-ray increase which was observed at M.I.T. (geographic coordinates 41°23′N, 71°08′W, sea level) on May 4, 1960. These data were obtained from three large meson telescopes, of total sensitive area 10 m^2, and total counting rate ≈ 900 counts sec^{-1}. The telescopes have been described elsewhere,[1] and it suffices to state that there are now 7.5 cm of lead between the scintillators. The minimum μ-meson momentum accepted by the telescope is now approximately 202 Mev/c.

The data from the telescopes are recorded as follows. (1) The counting rate from each telescope is accumulated over intervals of six minutes, and punched on tape in the form of binary numbers. (2) A printing register records the hourly totals from each telescope as decimal numbers. (3) The outputs from the three telescopes are combined, accumulated over intervals of 30 seconds, and the accumulated count registered on a chart recorder.

Figure 1 displays the 30-second counting rate data obtained between 1010 and 1110 U.T. on May 4, 1960. The total number of counts recorded in each 30-second interval is plotted as a percentage relative to the mean counting rate

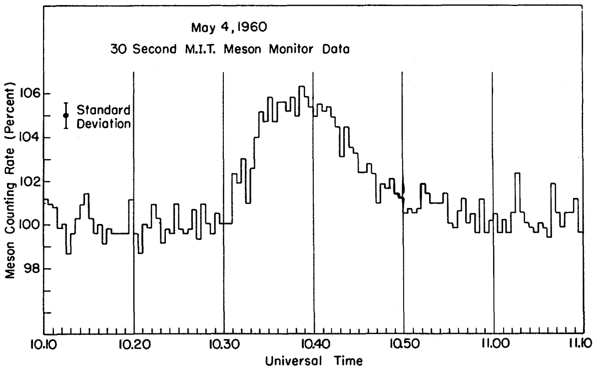

FIG. 1. The 30-second meson data observed at M.I.T. subsequent to the production of cosmic rays by the sun on May 4, 1960.

for the period 1010 to 1030. The standard deviation which is appropriate to any 30-second measurement is shown. To check the reliability of the data shown in the figure, we have examined the 6-minute and hourly counting rate data, finding that there is no significant difference between the variations observed by the three telescopes.

Comparison with WWV revealed that our time standard was lagging 8 seconds behind Universal Time: for example, the count total plotted between 1015 and 1015 + 30 seconds, was obtained between 10:15:08 U.T. and 10:15:38 U.T. No corrections have been made for changes of barometric pressure, as it remained constant over this hour to within 0.005 inch of mercury.

It is seen from the figure that the counting rate measurements remained at the pre-event value until 10:31:08. The next measurement, that is, the one obtained between 10:31:08 and 10:31:38, was 4 standard deviations above this value, and we therefore estimate that the first arrival of solar cosmic rays of energies ≈ 6 Bev at M.I.T. occurred no later than 10:31:38 and, probably, not before about 10:30:53. The maximum counting rate (6% above the pre-event value) was attained about 10:35 U.T., and after remaining at this value for about 5 minutes, the counting rate rapidly returned to the pre-event value, our data showing no significant continuation of the solar flare effect after 10:55 U.T.

According to a preliminary report issued by the High Altitude Observatory at Boulder, Colorado,[2] a flare of importance 2 was observed at 10:20 U.T. in an active region on the western solar limb. As no other solar flares were reported to have occurred at this time, we conclude that the cosmic radiation was generated in this flare.

The most outstanding feature of the cosmic-ray effect reported in this communication is the very short time scale—the rising intensity and decaying intensity phases being much shorter than those observed during any previous case of this type event. A study of the temporal dependence of all recorded cases of the cosmic-ray flare effect has been completed recently, and a model of the magnetic configurations in the sun-earth region has been constructed. These results will be published elsewhere in the near future. It suffices to say here that, on the basis of the model applicable on May 4, the short time scale would be explained in terms of the earth being within an essentially radial field which was rooted in the active region on the sun. The very short time scale suggests that there would be relatively few irregularities in this field and, consequently, the radiation arriving at the earth would be largely collimated along the lines of the field. This predicts that during the May 4 event (1) impact zones were very pronounced, (2) there was little time dispersion between the high- and low-energy particles, and (3) the effect observed by stations outside the impact zones was relatively small. It is highly desirable that data with good time resolution from many parts of the world be compared to determine whether these predictions were fulfilled.

The meson telescopes, with their fine-detail timing circuits, were designed by Professor R. W. Williams and Mr. R. D'Arcy for the specific purpose of studying cosmic-ray flare increases in detail.

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[*] This work is supported in part by funds provided by the U. S. Atomic Energy Commission, the Office of Naval Research, and the Air Force Office of Scientific Research; and in part, also, by a grant from the National Science Foundation.

[†] On leave from Centro Brasileiro de Pesquisas, Rio de Janeiro, Brazil.

[‡] Sponsored by the World Wide Research Scientists project of the U. S. International Co-operation Administration.

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