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III-1-5. Hydrogen Nuclei of the Primary Cosmic Radiation

C. J. WADDINGTON

H. H. Wills Physical Laboratory, University of Bristol, England.
Temporarily at NASA, Goddard Space Flight Center, Greenbelt, Maryland, U.S.A.

In order to determine the intensity of hydrogen nuclei in the primary cosmic radiation, a 15 cc stack of nuclear emulsions was exposed over Texas on the 12th of July 1960. This exposure was made at a residual pressure of 4.5±0.3 mb and had a duration of 624 mins. The stack was mounted at least 15 meters above the other equipment carried on the same balloon and was rotated through 180° when the balloon had reached a residual pressure of 11 mbs, 30 mins before reaching ceiling altitude.

The proton intensity was determined from an examination of the nuclear interactions detected in the emulsions, in a similar manner to that employed previously, Waddington (1960). The intensity, $J(x)$ was given by $J(x) = (\lambda dN)/V\pi t$ particles per m². st. sec. Where λ is the interaction mean free path of protons in emulsion, taken from machine data to be 37.2±0.8 cms, V is the volume, in m³; t the duration of the exposure in seconds; and dN is the *true* number of interactions produced by singly charged primary particles in the scanned volume.

In order to calculate dN a correction must be made for those interactions which are inevitably missed in the scanning. Preliminary high energy machine data used previously led to a correction factor for those interactions where less than 5 low energy secondaries were formed of 1.56±0.07, but additional data now available suggests a higher factor of 1.74±0.04, and this has been used in this work. The use of this higher factor changes the previously published value for the intensity at the top of the atmosphere from 500±60 protons per m². st. sec. to 540±60 protons per m². st. sec.

In this experiment $J(x)=600\pm60$ protons per m². st. sec. In order to find the intensity at the top of the atmosphere this value had to be corrected for those particles which entered during the 30 minutes between the stack turning over and the balloon reaching ceiling, and for the effects of the overlying atmosphere. This correction was obtained using the model derived previously, version (*c*), and gave a primary intensity of

$$J(0)=540\pm50 \text{ protons per m}^2\text{. st. sec.}$$

This value is not particularly sensitive to the model used for the correction, since the correction is only some 10 percent of the observed intensity.

This intensity may be compared with those obtained at other times by McDonald and Webber (1959), by relating their value to the neutron monitor counts at the time of each experiment, and thus predicting the value that they would have observed at the date of this experiment. This predicted value is 500 protons per m². st. sec. which compares well with that obtained here. It thus appears that it is improbable that there are any serious errors either in this data, or in that of the counter determinations, and that emulsions are well suited to determining the intensities of high (>1−2 BeV) energy protons.

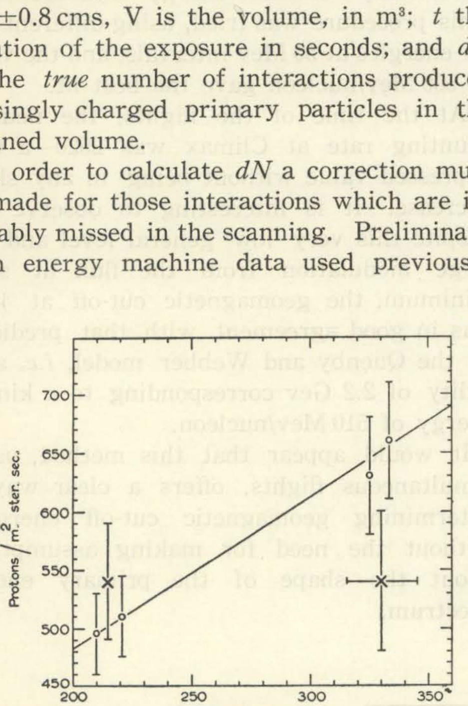

Fig. 1.

References

1) McDonald, F. B. and Webber, W. R. (1959) Phys. Rev. **115** 194.
2) Waddington, C. J. (1960) Phil. Mag. **5** 1105.