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III-1-4. Primary Cosmic-Ray α-Particles over North America

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During the past few years, several high altitude balloon flights have been made ever North America, at geomagnetic latitudes between 41° and 61°. Nuclear photographic emulsions have been used to study the characteristics of the primary He-nuclei in the cosmic radiation.

At 41°N, in emulsions flown on 8 February 1959 and analysed by D. E. Guss, the flux of He-nuclei was found to be 76±4 particles/m² ster sec. Glass-backed emulsions developed isothermally at 10°C were used in this work, and were found to have unusually low distortion. This permitted high energy measurements to be made with the multiple scattering technique. The slope of the integral energy spectrum was found to be $\gamma = 1.48\ ^{+.17}_{-.14}$, and the corresponding value of the local geomagnetic cutoff energy 1.69±.23 Gev/nucleon kinetic energy. These measurements are described in detail in a paper to be published in Il Nuovo Cimento, and the details of the method of noise and spurious scattering estimation and elimination will be dealt with in a paper by D. E. Guss and M. W. Friedlander.

On 3 August 1958, two balloon flights were made simultaneously, one at 61°N, from Neepawa, Canada, and the other from 49°N (Moberly, Missouri). There were emulsion stacks on both flights; the analysis of those on the northern stack was carried out at the University of Oxford (Engler *et al*, Nuovo Cimento, 20, 1157 (1961)), and the data from the southern flight are presented here. (These will appear, in detail, in a paper by M.W. Friedlander and T. Spring, in Nuovo Cimento.) The flux observed at 49° was 88±8 particles/m² ster sec, and at 61° it was 135±8 particles/m² ster sec. In the figure are displayed the differential energy spectra observed on the two flights. It can be seen that there is generally good agreement. The line designated as A, is taken from the paper of Engler *et al*, and is a good fit to their data. The line B is obtained by using line A, imposing a cutoff at 500 Mev/nucleon kinetic energy and estimating the effect of the statistical uncertainty in the energy measurements. This procedure was tried, using different cutoff energies at 50 Mev intervals, and the value of 500 Mev/nucleon gave the best fit.

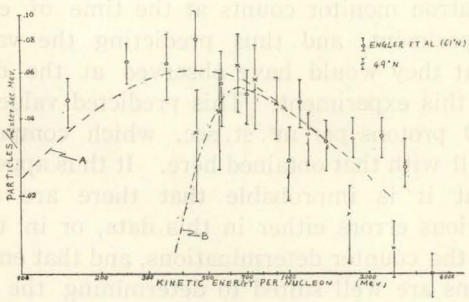

Fig. 1.

At the time of the flights, the neutron counting rate at Climax was 2520—a very depressed value without being in any sharp decrease. It is interesting to observe that despite this very low general level and the large modulation from the flux at solar minimum, the geomagnetic cut-off at 49°N was in good agreement with that predicted by the Quenby and Webber model, *i.e.* a rigidity of 2.2 Gev corresponding to a kinetic energy of 510 Mev/nucleon.

It would appear that this method, using simultaneous flights, offers a clear way of determining geomagnetic cut-off energies, without the need for making assumptions about the shape of the primary energy spectrum.