within the statistical errors. Due to the close similarity of the second- and third-forbidden correction functions it will be difficult to reject the former in the case of K^{40}. The two fourth-forbidden correction factors (spin change 4, no parity change) given by Marshak need not be considered since they are readily distinguished from the second- and third-forbidden factors. For the present the beta-ray spectrum of K^{40} may be regarded as agreeing with the theory although unique proof of this is not possible with the data presented here.

The author is indebted to Dr. C. P. Keim of Oak Ridge for his special efforts in furnishing the enriched source making this experiment possible.

* Work performed at Brookhaven National Laboratory under the auspices of the AEC.

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Evidence from Cosmic-Ray Bursts for a Nuclear Cascade Process*

G. N. Whyte
Palmer Physical Laboratory, Princeton University, Princeton, New Jersey
April 10, 1950

THERE exists considerable indirect evidence for a substantial multiplication of the star-producing component of the cosmic radiation by a nuclear cascade process. For example, Hazen[1] has reported that more than half of the stars observed in a cloud chamber at 10,000 ft. are producted by neutrons; since most, if not all, of such neutrons are believed to *originate* in stars, this observation implies a nuclear cascade. Bernardini *et al.*[2] conclude from photographic plate data on stars that "each primary proton gives rise on the average to more than 10 secondary nucleons having energies of the order of magnitude of some hundreds of Mev." A number of cloud-chamber pictures[3,4] have actually shown an ionizing particle from one star giving rise to another star. The experiments described below provide a somewhat more direct measure of the build-up of the star-producing component in the atmosphere.

A number of thin-walled, spherical ionization chambers have been flown to altitudes exceeding 90,000 ft. at geomagnetic latitudes 0°, 29° and 35°N, extending the work done by Coor[5] at 52°. Each chamber was 30 cm in diameter and was filled with pure argon at 1.4 atmospheres. Electron collection was used. Burst sizes were measured in terms of standard pulses due to polonium alpha-particles, with which the chambers were calibrated periodically. Bursts ranging in size from 0.7 to 20 Po alpha were recorded.

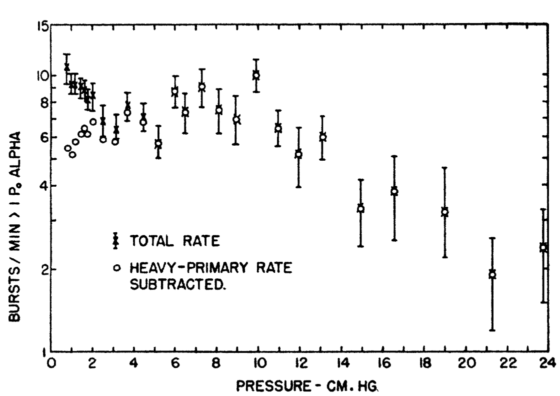

FIG. 1. Variation of burst rate with atmospheric depth.

The flights were sent up by balloon from the U. S. S. Norton Sound in the Pacific during July and August of 1949.

The crosses in Fig. 1 show the variation of the burst rate at 0° as a function of atmospheric depth for bursts greater than 1 Po alpha. The points have been obtained by averaging the results of 3 flights. The initial rapid fall-off in the rate with increasing depth is believed to be due to heavy primary nuclei of $Z \geq 12$, which can cause bursts by ionization in passing through the chamber and which are quickly absorbed by collisions with air nuclei. Bradt and Peters[6] have measured the primary fluxes and mean free paths for collision of such particles at 30° and 51°. From the approximate energy spectrum deduced from these measurements by Vallarta[7] and the geomagnetic cut-off energies at 30° and 0°, one can estimate the flux at 0°. Using this flux and the appropriate mean free paths, one can calculate the burst rate to be expected from heavy primaries as a function of atmospheric depth.

The circles in Fig. 1 have been obtained by subtracting the heavy primary rate from the total rate. Coor has estimated the burst rate due to electron showers at these altitudes to be quite negligible, so that the corrected rate is believed to be due predominantly to nuclear disintegrations and furnishes a measure of the flux of star-producing particles. It will be observed that this flux increases with increasing depth to a maximum around 7 cm Hg before falling off in the usual fashion. Such behavior is consistent with a nuclear cascade picture, according to which each primary particle produces a star, some of the secondaries from which are in turn able to produce stars, the process continuing to the stage where the secondaries have insufficient energies to cause further disintegrations.

A more complete and quantitative report on this work is in preparation.

Sincere thanks are due Dr. G. T. Reynolds for his interest and advice, Mr. Robert Price for his assistance with the flights, and the personnel of the U. S. S. Norton Sound for their unfailing cooperation.

* Assisted by the joint program of the AEC and the ONR.

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Optical Absorption in Strontium Oxide Films

Robert L. Sproull
Department of Physics, Cornell University, Ithaca, New York
April 13, 1950

MEASUREMENTS of the optical absorption of strontium oxide were undertaken as part of a study of the properties of the alkaline earth oxides. The technique and apparatus used were identical with those used by Tyler[1] in his study of barium oxide films.

A platinum-rhodium (Baker No. 750 alloy) filament, 0.005 in. ×0.092 in., was outgassed in vacuum at 1600°C for two hours. It was then coated to a depth of about 20 mg/cm² with Mallinckrodt "ultra-pure" strontium oxide in a minimum of nitrocellulose, amyl acetate binder (tested for the absence of barium). The filament was heated slowly in the vacuum system, the carbonate converted to oxide, and outgassed for four hours at 1350°C. During this period, any barium oxide should evaporate preferentially. This selective evaporation has recently been analyzed by Moore and Allison,[2] whose work indicates that the concentration of barium oxide in a BaO-SrO mixture should be considerably reduced by this procedure. Fused quartz plates were coated by evaporation from the strontium oxide source thus prepared.