Table I. Details of ionization measurements on the antiproton track.

Plate	Total corrected range	Range counted	No. grains	Minimum	g^*	Effective range from $\overline{\Lambda}^0$-decay
1	2.78 mm	2.27 mm	718	15.00	2.104	1.13 mm
2	5.88	4.72	1572	15.51	2.150	5.72
3	6.59	5.11	1780	15.62	2.230	11.98
4	6.78	5.42	1890	15.39	2.260	18.67
5	5.09	4.56	1601	15.19	2.316	24.84

sities have then been normalized to the minimum ionization value via the plateau[1] in each plate. It is clear that the track increases in ionization towards the star. The star has therefore been identified as an antiproton interaction in flight. The best value of the antiproton energy at the decay point is 230_{-7}^{+22} Mev. The opening angle of the V is 64 ± 1° and the π^+-meson energy is 32 Mev from a range of 1.70 cm in emulsion.[2] From these values the Q value in the decay has been calculated to be $35_{-0.9}^{+2.6}$ Mev, this is in excellent agreement with that for the normal Λ^0 hyperon: 37.45 Mev.[3]

One cannot of course completely rule out the possibility that the decay event is really the interaction of an antineutron charge-exchanging into an antiproton and also creating a π^+ meson, but the visible energy in the star, coupled with the direction of the connecting track and the apparent Q value in the decay, makes the $\overline{\Lambda}^0$ hyperon the only reasonable interpretation.

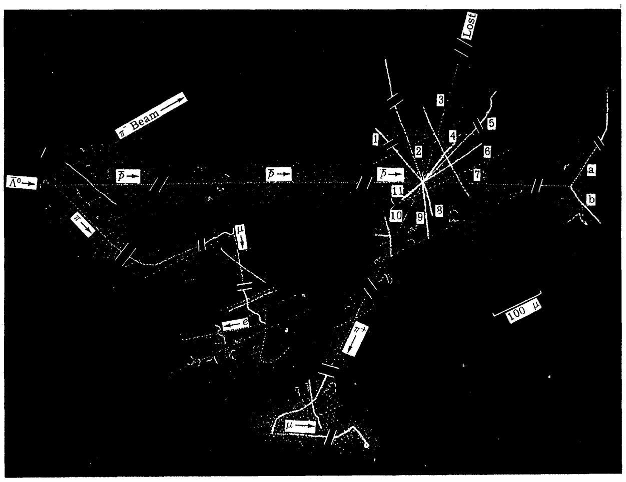

FIG. 1. Drawing of the event. The $\overline{\Lambda}^0$ hyperon enters from the left in the direction indicated. The antiproton track is shown and is almost horizontal. The star apparently caused by the interaction of the antiproton in flight has 11 prongs, all but one of which have been arrested in the emulsion. Of the three shower tracks, one interacts in flight and a second decays at rest. The π^+-meson track resulting from the decay of the antihyperon is shown decaying into a μ meson and thence to an electron.

We would like to thank Dr. E. J. Lofgren and his colleagues at the Bevatron for making the exposure possible. We are grateful to Professor D. H. Wilkinson and Dr. W. Chupp who carried out the exposure. We are indebted to Professor C. F. Powell, Professor N. Dallaporta, Dr. D. Evans, Dr. D. H. Stork and Professor W. F. Fry for many very useful discussions.

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*A very preliminary report of this event was made at the Washington Meeting of the American Physical Society in May, 1958 [M. Baldo-Ceolin and D. J. Prowse, Bull. Am. Phys. Soc. Ser. II, 3, 163 (1958)]. A more detailed account than is given in this letter will be published elsewhere.

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‡On leave from the University of Bristol, Bristol, England.

[1] G. Alexander and R. H. W. Johnston, Nuovo cimento 5, 263 (1957).

[2] Barkas, Barrett, Cuer, Heckman, Smith, and Ticho, Nuovo cimento 8, 186 (1958).

[3] W. H. Barkas, Proceedings of the Padua-Venice Conference on Mesons and Recently Discovered Particles, 1957 (to be published).

BERYLLIUM-7 EXTREME HIGH-TEMPERATURE EXPERIMENT

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The recent attainment of extreme high temperatures of milliseconds duration suggests a rather interesting experiment.[1] It is known that Be^7

decays by a 100% K-capture process with a 52-day half-life. The decay proceeds in two branches; 88% of the transitions go directly to the ground state of lithium, and the remaining 12% to an excited state of lithium followed by a 0.48-Mev gamma ray. The Be^7 photopeak is easily detectable by using a conventional NaI crystal spectrometer in view of the large photoelectric-to-Compton cross section ratio at this energy.

Since the fourth ionization potential in Be is 216 ev, one would expect that the introduction of the isotope into a high-temperature discharge (2.5×10^6 to 10^7 degrees Kelvin; 216 ev to 860 ev) would result in complete ionization of the Be. By monitoring the 0.48-Mev line with the proper discrimination and shielding against the softer x-rays, one should observe the stripping of the K electrons for the duration of the high temperature by measuring the drop in the number of counts in the photopeak. Assuming high-temperature times of millisecond duration, the experiment could be carried out with a millicurie source if properly introduced into the discharge tube. The experiment would be of interest as a possible method of high-temperature thermometry in the million-degree range and also provide information regarding electron-nucleus interaction in K-capture processes.

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[1] P. C. Thonemann *et. al.*, Nature 181, 217 (1958).

TRAPPED ALBEDO THEORY OF THE RADIATION BELT

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We describe here a theory for the radiation belt of the earth which gives the energy spectrum, angular distribution, and intensity of the radiation with distance from the earth. Our results are not compatible with data reported by Explorer satellites I and III (where the observed intensity did not rise appreciably below 1000 km)[1] but are compatible with preliminary reports from Explorer IV.[2]

The earth's dipole field provides an excellent trapping field not only for the magnetic storm-producing solar corpuscular radiation but also for cosmic-ray albedo particles.[3] Because of the long lifetimes which are possible we must investigate all likely injection mechanisms. From (12^*) and (13^*) it is evident that, e.g., high-energy electrons could stay trapped for long times. However, we have found no adequate production mechanism.[4]

On the other hand, the injection of protons arising from the decay of upward-projected neutrons gives an adequate value of Q. Because of the long neutron lifetime, we can have copious neutron production in stars in the dense lower atmosphere with protons released in regions of very low density. The release rate is not very altitude sensitive, leading to constant Q referred to earlier,[3] and therefore to the possibility of using the radiation belt as a tool for study of the exosphere.

The situation has been considered in detail for the equator up to ~1 earth radius (R_E=4000 miles), since experiments, e.g., a rocket measurement of flux vs altitude, could be analyzed most simply.

Within experimental uncertainties, the primary flux J is about $10^{-1}\text{cm}^{-2}\ \text{sec}^{-1}$. Each primary is assumed to produce 7 stars[5]; we estimate that ~2.5 are effective, i.e., sufficiently high in atmosphere to allow neutrons to escape. The neutron spectrum for the average star in nitrogen is given as [6,4] (derived from Bristol star data)

$$i_n(E)=8E^{-1.8}\ \text{per Mev or}\ i_n(\beta)=0.12\ \beta^{-2.6}\ . \tag{1}$$

Thus the spectrum of neutrons emitted upwards per cm^2 per sec is

$$J_n(\beta)=0.03\ \beta^{-2.6}\equiv C_1\beta^{-\gamma}. \tag{2}$$

Since the effect of absorption and decay on the neutron flux can be neglected, we are justified in assuming a constant "brightness" with altitude, at least for a fraction of R_E. Thus the source function of decay protons $Q(\beta)$ can be assumed uniform over moderate altitudes; it is also reasonably isotropic:

$$Q(\beta)=(\Lambda/c)C_1\beta^{-(\gamma+1)}=C_2\ \beta^{-(\gamma+1)}, \tag{3}$$

where $\Lambda=9\times10^{-4}\ \text{sec}^{-1}$.

We next investigate the fate of the protons: (i) Coulomb scattering which leads to diffusion in α and leakage from the trap[3]; and compare it to (ii) energy loss by collisions. We will find the latter to be more important for protons with $\beta<1$.

For the nonrelativistic case we find the mean