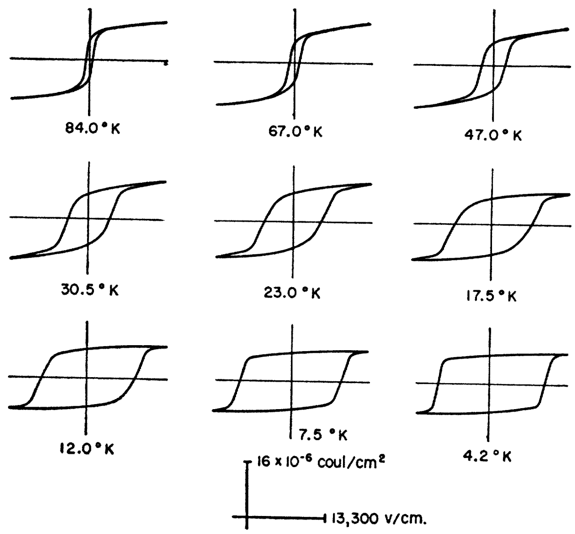

FIG. 1. Hysteresis loops for $BaTiO_3$ at low temperatures.

polarization. This stays almost constant from the 180°K transition down to 4.2°K; its value is of the order of about $P_s \simeq 8.0 \times 10^{-6}$ coulomb/cm². The absolute value changes from sample to sample because of domain formation at the two transition points[3] near 270° and 180°K. In interpreting P_s it must be kept in mind that below the 180°K transition the polar axis points in the (111) direction.[3] The coercive field strength increases strongly from about 250 v/cm at 180°K to almost 10,000 v/cm at 4.2°K (Fig. 2).

These results show that $BaTiO_3$ stays ferroelectric down to liquid helium temperature, and there is no indication that the crystal will change to a nonferroelectric modification. The fact

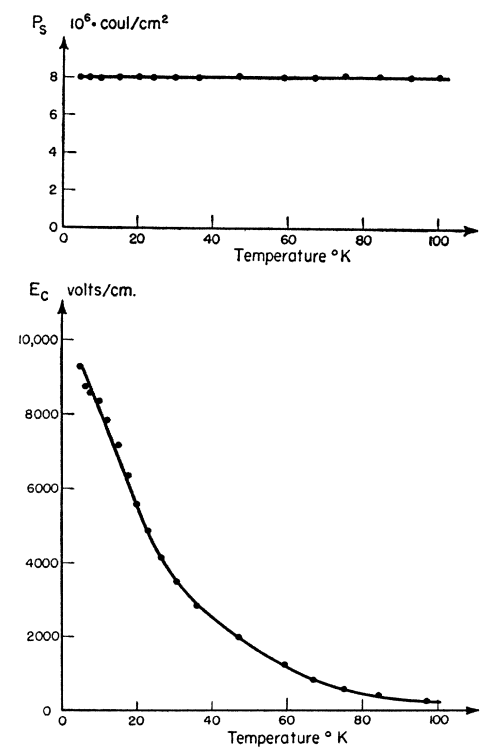

FIG. 2. Spontaneous polarization and coercive field strength *vs* temperature.

that the coercive field strength increases strongly at low temperatures and that the hysteresis loops become wider and more and more rectangular indicates freezing-in of the domain boundaries. It is of interest to note that $BaTiO_3$, while becoming ferroelectric by a displacive transition similarly to rochelle salt (small specific heat anomaly) and, in contrast to the KH_2PO_4 group, shows no second curie point at which the ferroelectricity disappears as in the case of rochelle salt.

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The Intensity of the Total and of the Hard Component of the Cosmic Radiation as a Function of Altitude at Geomagnetic Latitudes of 28° N and 55° N*

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THE equipment used in this experiment consisted of four fourfold coincidence counter telescopes (*ABCD, BCDE, BCDF, BCDG*). The counter geometry of the individual telescopes is shown in Fig. 1. Each counter had an outside diameter of 2.54

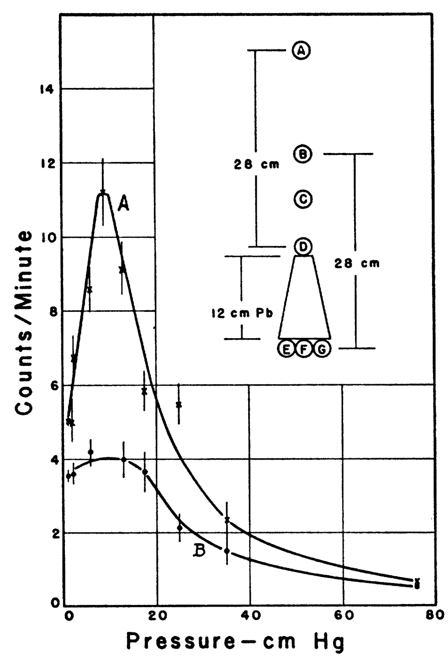

FIG. 1. Measurements at 28°N geomagnetic latitude (Cuba).

cm, a length of 13 cm, and brass walls of 0.078 cm in thickness. A block of 12 cm of lead was interposed between counter *D* and counters *EFG*. Each fourfold coincidence was separately registered on photographic film moved by a clock mechanism.

Through the courtesy of the Office of Naval Research, the first of the two balloon experiments was carried out with the aid of a General Mills balloon launched south of Cuba at a geomagnetic latitude of 28°N. The launching took place from the deck of an aircraft carrier of the U. S. Navy on November 19, 1949. The balloon rose at the rate of 680 ft/min to a maximum altitude of 93,000 feet corresponding to an atmospheric pressure of 1.2 cm Hg and remained between a pressure of 1.2 and 1.4 cm Hg for several hours. The equipment landed in the ocean and was promptly recovered by a helicopter.

Curves A and B in Fig. 1 give the counting rates obtained during this flight for the fourfold coincidences *ABCD* and *BCDF*, respectively. Curve A is assumed to give the total vertical flux of the cosmic radiation at 28°N. The maximum in the total radiation occurs at a pressure of 9 cm Hg and represents an increase by a factor of 18 from its value at sea level. Curve B gives the intensity of the cosmic radiation capable of traversing 12 cm of lead (penetrating component). As is evident in Fig. 1, curve B flattens out appreciably above 18 cm Hg pressure and shows a definite drop between 5 and 1 cm Hg. The penetrating component increases by a factor of 8 from its value at sea level to that at the very flat maximum (∼9 cm Hg).

The second experiment, in which an identical piece of apparatus was used, was carried out at a geomagnetic latitude of 55°N. For this purpose a General Mills balloon was launched from Minneapolis, Minnesota, on June 6, 1950. The balloon rose at the very slow rate of 311 ft/min to an altitude of 70,000 ft and continued to rise even more slowly (∼150 ft/min) until it leveled off for several hours at an altitude of 86,000 ft. This type of flight is particularly valuable for securing accurate counter coincidence data at various atmospheric depths.

The results obtained are shown in Fig. 2. The maximum in the total component occurs at an atmospheric pressure of 5 to 6 cm Hg and represents an increase by a factor of 35 from its value at sea level. The hard component, as measured through 12 cm of lead, flattens out above 5 cm Hg, exhibiting a small maximum at a pressure of about 3 cm Hg. The increase from sea level to the maximum corresponds to a factor of 19.

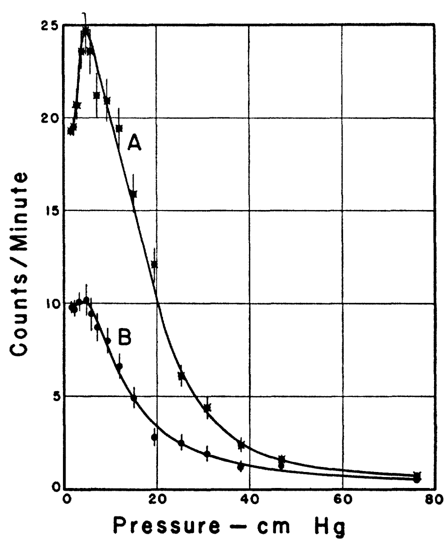

FIG. 2. Measurements at 55°N geomagnetic latitude (Minneapolis, Minnesota).

Comparison of the results obtained at the two latitudes gives a latitude effect of 2.75±0.21 for the hard component at an atmospheric pressure of 1.6 cm Hg. For the total radiation the latitude effect is 1.85 at 9 cm Hg (maximum at 28°N), 3.1 at 5 cm Hg (maximum at 55°N), and 3.85±0.13 at 1.6 cm Hg.

It is of interest to note that the latitude effect of the hard component is smaller than that of the total radiation at the maximum altitude of 85,000 ft.

Winckler[1] has measured the latitude effect of the total radiation in a series of balloon flights and obtains results in good agreement with the ones presented here. However, an accurate comparison of the data is not possible owing to the different counter geometry and the thickness of lead in the counter telescope used in his equipment.

A more detailed discussion of the results will be published later.

The authors wish to thank the Office of Naval Research and the General Mills Company for their valuable cooperation.

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

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An 8×10⁻¹⁰-Sec Isomeric State in $_{76}Os^{186}$

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An excited state in $_{76}Os^{186}$ with a half-life $(8\pm1)\times10^{-10}$ sec has been observed with a delayed coincidence scintillation spectrometer. The data have been analyzed by a graphical method which is analogous to a method of analysis recently reported by Newton.[1]

Re^{186} (90 hr) is known[2] to decay in 90 percent of its disintegrations by β^- emission into Os^{186}. A 25 percent partial β^- spectrum of 930-kev end point is followed by a 137-kev γ-ray, and the remaining β^- disintegrations lead directly to the ground state. For the 137-kev γ-ray, Metzger and Hill measured $\alpha_K=0.35\pm0.1$ and $N_K/N_L=0.6\pm0.1$.

Curve (1) of Fig. 1 shows the number of coincidences as a function of delay time obtained with a source of Re^{186}. This delayed coincidence resolution curve was recorded by exciting one channel of the delayed coincidence apparatus by 250- to 450-kev nuclear beta-rays and the other channel by the *L* and *M* internal conversion electrons of the 137-kev transition. Without a change in the apparatus, a resolution curve for prompt events was obtained with a source of Au^{198}. The prompt coincidences are (a) between 110- to 150-kev nuclear beta-rays and conversion electrons of the 411-kev transition and (b) between 110- to 150-kev Compton recoil electrons from 411-kev γ-radiation and 250- to 450-kev nuclear beta-rays. Curve (2) shows the result of such a measurement. Since curves (1) and (2) overlap appreciably, the half-life of

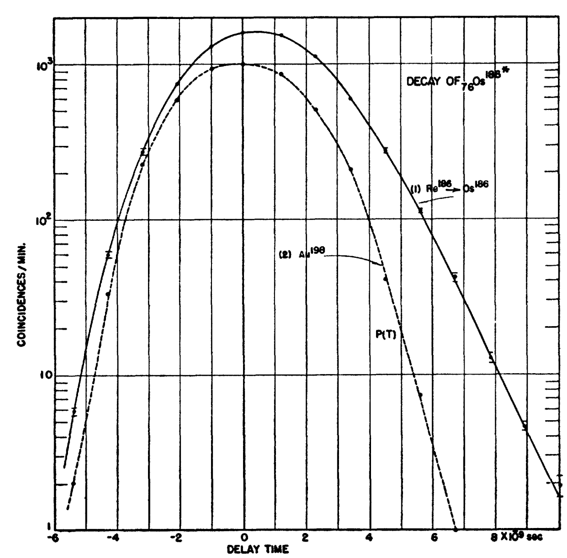

FIG. 1. The number of delayed coincidences as a function of delay time.