Rochelle-salt single crystals of sufficient size are known to have a domain structure in the ferroelectric temperature range.[2] Adjacent domains differ in the direction of the spontaneous polarization (either parallel or antiparallel to the x crystallographic axis). Accompanying this polarization is a shearing strain in the y–z plane, and as a result the boundaries will be regions of strain from which reflections of ultrasonic waves may occur. Studies of powder patterns on the surface of rochelle-salt crystals indicate the domains form laminae 1 to 8 mm thick in the y direction and 1 cm or more in extent in the x and z directions.

In the observations reported here, and x cut quartz transducer is cemented to one surface of a rochelle-salt single crystal cut in the shape of a rectangular parallelepiped with dimensions approximately 1 in. When the piezoelectric transducer is excited by an electrical pulse of the 10-Mc/sec. carrier frequency, an ultrasonic pulse travels through the rochelle-salt crystal and is reflected at the opposite surface. Upon returning to the transducer it is detected by the resulting electrical pulse in quartz and again reflected into the rochelle-salt specimen. The successive echoes are displayed on a cathode-ray tube.

When a compression wave is propagated along the y crystallographic axis of the rochelle-salt crystal, echoes with intensity about 40 decibels below those from the crystal surfaces are observed from the interior of the crystal. These echoes are present only in the temperature range where the crystal is ferroelectric and disappear gradually as the temperature approaches the Curie temperature (24.2°C).

When a d.c. bias field is applied in the x direction, these domain echoes are found to reduce in intensity until with a field of about 100 volts/cm, their level is at least 25 decibels below that with zero bias field. With larger fields it is found possible to reduce their level down to the noise level of the amplifier. The field necessary to reduce the domain echo intensity decreases as the upper Curie temperature is reached. The application of a sufficiently large biasing field will, of course, result in all the domains becoming polarized and sheared in the same direction; the observations of the domain echoes indicate that in this condition the strained regions at the domain boundaries are at least partially removed.

It has not been found possible to resolve the domain echoes and therefore no information has been obtained about the location or number of domains. It is felt that the best method of obtaining quantitative information is to observe the change in intensity of the echoes from the air boundaries as the domain structure is changed.

Domain echoes have also been observed when the pulse is propagated along the z direction. These echoes are about 15 decibels below those observed in the y direction. The lower intensity is accounted for by the smaller area of the domain boundaries normal to the z direction.

No indication of the Barkhausen effect has been observed in this work.

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The Energy Distribution of Neutrons in the Atmosphere

S. A. Korff, M. S. George, and J. W. Kerr
New York University, New York, New York

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THE energy distribution of neutrons produced by the cosmic radiation in the free atmosphere has been computed by Bethe, Korff, and Placzek.[1] Experimental tests of these predictions have been made by Korff and Hamermesh[2] and by Agnew, Bright, and Froman.[3] The first of these tests was made by an instrument carried up to altitudes of about 40,000 feet (2 meters of water equivalent below the top of the atmosphere), in a free balloon flight, and the second in a B-29 at altitudes of from 20,000 to 36,000 feet. In both experiments the counting rate in a boron trifluoride counter was determined with and without boron and cadmium shields.

On September 27, 1947, we conducted a balloon flight which reached an altitude of 66,000 feet (4 cm Hg), at which altitude it remained for many hours. Our counter contained 1050 cc of ordinary BF_3 at 14-cm Hg pressure. This flight employed the same instrumentation as our previous one, in that the counting rate of a neutron counter was determined with boron and cadmium shields automatically covering and uncovering the counter at predetermined intervals. The counting rates observed with this instrument at the top altitude were as follows: 16.8 counts per minute (O) unshielded, 7.55 counts per minute (C) with 0.7-mm Cd shield, 4.48 counts per minute (B) with 7-mm powdered B_4C shield.

It will be noted that the counting rates ($B:C:O$) stand in the ratio of 1:1.69:3.75. At 30 cm Hg, Agnew, Bright, and Froman find ratios of approximately 1:1.7:4.2. We obtain a ratio $O:C$ of 2.22. This is slightly greater than the ratio obtained in our previous flight; the difference is attributable to increased accuracy. There appears to be no evidence that these ratios vary with altitude in the presently observed range, i.e., from a thousand meters above ground up to 66,000 feet.

The absolute number of neutrons is not determined in a flight of this sort, for it is necessary to set the amplifier bias to such a value to exclude spurious counts that some of the neutrons are missed. The absolute counting rate will yield only a lower limit to the neutron intensity.

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