mesons and the nucleons to survive longer than the electrons, hence to arrive in the lower atmosphere accompanied by ionizing particles with extremely low densities. On the other hand, evidence has been found[7] that an appreciable fraction of the penetrating showers do not contain any electro-magnetic radiation. If this kind of process is possible at high energies, part of the penetrating component could be created without the accompanying electrons of the extensive showers.

Support for the hypothesis that all particles observed in the lower atmosphere are generated in extensive showers, is provided by the facts that, whenever three or more coherent penetrating particles coming from the air have been recorded, an extensive shower accompanying them has been recorded too; and that the probability of recording an extensive shower accompanying the N-component increases when the energy of the N-component increases.[8]

[1] We disregard here the tail of primary radiation which may cross the atmosphere without interacting with any nucleus of the air.
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Disintegration Scheme of Scandium [46]

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THE disintegration of the ground state of Sc^{46} was described previously as a complex beta-decay followed by emission of two successive gamma-rays. The predominant disintegration was found to be beta-emission of 0.36 Mev. The relative abundance of a second beta-emission of 1.49 Mev was determined to be six percent and later this was reduced to two percent.[1] In subsequent work with a magnetic lens spectrometer and coincidence counter these results on the beta-disintegration of 1.49 Mev were not confirmed.[2-4]

In recent work the successive emission of gamma-quanta of 1.12 Mev and 0.89 Mev by excited states of Ti^{46} was designated as electric quadruples with no change in parity.[5] Consequently additional information on the 1.49-Mev beta-decay would be of value in assignment of the angular momentum of Sc^{46}.

For the present work scandium oxide was activated by neutrons at the Oak Ridge National Laboratory. This was chemically purified and first studied with G-M coincidence counters. The arrangement of the coincidence counters allowed the use of G-M tubes of different potentials with resolving time of about 10^{-7} sec.

From determinations of beta-gamma- and gamma-gamma-coincidences the following results were obtained. The end point at 110 mg cm^{-2} of Al for the emitted beta-radiation in coincidence with gamma was in agreement with the previous value known for the beta-disintegration of 0.36 Mev. The beta-gamma-coincidences per beta recorded and gamma-gamma-coincidences per gamma recorded gave 5.01×10^{-3} and 2.50×10^{-3} values respectively. These correspond to a simple beta-spectrum followed by two gamma-rays in cascade with an upper limit for a second beta-disintegration of 0.2 percent.

With the aim of improving the upper limit of the second beta-disintegration Sc^{46} was studied in a cloud chamber. The sample was placed on zapon film and mounted in the center of the chamber. Eleven thousand tracks of electrons of energies less than 0.36 Mev were obtained in a magnetic field. Only twelve tracks were found having energies higher than 0.36 Mev. Of these ten electrons were in the range between 0.65 Mev and 0.9 Mev. With the assumption that some electrons in this energy range are due to scattering and to internal conversion of the gamma-rays emitted the upper limit for the beta-decay of 1.49 Mev in Sc^{46} can be estimated as less than 0.05 percent of the 0.36-Mev beta-disintegration.

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The Microwave Spectrum of BrCl

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BY mixing Br_2 and Cl_2, an equilibrium is established between these two halides and BrCl. With equal amounts of Br_2 and Cl_2 at room temperature, a mixture containing roughly 60 percent BrCl is obtained rapidly, but because of the speed of reaction this BrCl is not separated readily.[1] An unseparated mixture has been employed to observe the transitions corresponding to the $J=0\rightarrow1$ rotational spectrum of BrCl in the region of 9000 Mc/sec.

Since there are two isotopes for Br and Cl, there are four isotopic species of BrCl. All of the nuclei have spins of $\frac{3}{2}$ and exhibit appreciable quadrupole coupling. In all, some 29 lines have been observed and their frequencies measured. Two of these lines correspond to the two strongest transitions of the molecules in the first excited vibrational state.

All of these lines have been identified, and the parameters of the molecule obtained using the method of Bardeen and Townes[2] for the first-order quadrupole coupling and for the second-order quadrupole coupling due to the bromine,[3] the latter being of the form $(eqQ\mathrm{Br})^2/B$. Second-order coupling terms of the form $(eqQ\mathrm{Cl})(eqQ\mathrm{Br})/B$ and $(eqQ\mathrm{Cl})^2B$ have not been included. The precision of the measurements does not justify introducing magnetic coupling terms of the form $c(\mathbf{I}\cdot\mathbf{J})$. In Table I the calculated values of the transition frequencies using the parameters given in Table II, are compared with the observed frequencies, and the differences are given. The designations are those of the final $J=1$ state. The average deviation of 140 kc/sec. is to be compared with the average probable error of the individual measurements of 110 kc/sec. For the $F_1=\frac{1}{2}$, $F=2$ transitions, the deviations are all anomalously large, but the manner of

TABLE I. Frequencies of BrCl transitions in Mc/sec.

Designation F_1	F	$Br^{79}Cl^{35}$ Observed frequency	$Br^{79}Cl^{35}$ Computed frequency	Dev.	$Br^{81}Cl^{35}$ Observed frequency	$Br^{81}Cl^{35}$ Computed frequency	Dev.
3/2	2	9307.96	9307.97	0.01	9209.57	9209.51	0.06
3/2	3	9291.61	9291.50	0.11	9193.26	9193.16	0.10
5/2	1	9088.61	9088.32	0.29	9026.17	9026.21	0.04
5/2	4	9080.73	9080.71	0.02	9018.40	9018.50	0.10
5/2	2	9074.91	9074.78	0.13	9012.97	9012.83	0.14
5/2	3	9063.77	9063.91	0.14	9001.44	9001.63	0.19
1/2	2	8899.50	8899.87	0.37	8865.66	8865.26	0.40
5/2	$4v=1$	9034.14	9034.27	0.14	8972.41	8972.50	0.09
		$Br^{79}Cl^{37}$			$Br^{81}Cl^{37}$		
3/2	2	8964.19	8964.18	0.01	—	8865.82	—
3/2	3	8951.38	8951.36	0.02	8852.93	8852.97	0.04
5/2	1	8745.17	8745.20	0.03	8683.06	8682.72	0.34
5/2	4	8738.47	8738.71	0.24	8676.37	8676.37	0
5/2	2	8733.84	8733.83	0.01	8671.87	8671.66	0.21
5/2	3	8725.49	8725.40	0.09	8663.40	8663.22	0.18
1/2	2	8559.58	8559.15	0.43	8525.53	8626.03	0.50