

It is possible that the observed large angle sprays of electrons are due to the tail of large cascade showers whose core is traveling more or less parallel to the lead plates. There is little direct evidence against this explanation of the sprays. However, there are three factors which make it appear to be unlikely. (1) The frequent appearance of heavy particles associated with sprays. (2) The fact that only two large cascade showers, at any angle to the plates, have been observed in all the pictures we have obtained above 90,000 ft. (3) According to other workers, the appearance of such sprays of electrons is a very rare event to mountain and B-29 altitudes, even though the relative frequencies of showers as compared to stars is much greater at these lower altitudes than in out flights.¹ At 90,000 ft. the wide angle sprays are quite frequent. The cloud-chamber sensitive time represented in Table I is about 3.5 sec.

We plan to continue to gather statistics of the occurrence of the sprays reported here. Although we have now observed five carbon interactions, we have not observed any sprays initiated in carbon. We hope, in the future, to be able to measure the momentum of the spray particles.

The balloon flights and the development of the cloud-chamber equipment of this work has been made possible through the assistance of the ONR and the AEC.

* Reported at the Echo Lake Conference of Cosmic Rays, June 22-28, 1949.

¹ An event which appears to be of the type described here has been seen by R. P. Shutt, Phys. Rev. **69**, 271 (1946).

The Determination of the Molecular Structure of Bromosilane by Microwave Measurements

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THE second and third rotational transitions, $J=1 \rightarrow 2$ and $J=2 \rightarrow 3$ of $\text{Si}^{28}\text{H}_3\text{Br}^{79}$ and $\text{Si}^{28}\text{H}_3\text{Br}^{81}$, have been measured and analyzed. The $J=2 \rightarrow 3$ transition of the rarer isotopic species of bromosilane, $\text{Si}^{29}\text{H}_3\text{Br}^{79}$, $\text{Si}^{29}\text{H}_3\text{Br}^{81}$, $\text{Si}^{30}\text{H}_3\text{Br}^{79}$, and $\text{Si}^{30}\text{H}_3\text{Br}^{81}$, were also observed. The nuclear and molecular constants are listed in Table I.

TABLE I. Nuclear and molecular constants of bromosilane.

		ν_0 (mc/s)	$I_B \times 10^{40}$ (g-cm ²)	$eQ(\partial^2 V / \partial Z^2)$ (mc/s)	B_0 (mc/s)
$J=2 \rightarrow 3$	$\text{Si}^{28}\text{H}_3\text{Br}^{79}$	25930.32	194.13	336	4321.72
	$\text{Si}^{28}\text{H}_3\text{Br}^{81}$	25755.89	195.44	278	4292.64
	$\text{Si}^{29}\text{H}_3\text{Br}^{79}$	25397.80	198.20		4232.96
	$\text{Si}^{29}\text{H}_3\text{Br}^{81}$	25222.21	199.58		4203.70
	$\text{Si}^{30}\text{H}_3\text{Br}^{79}$	24896.33	202.19		4149.39
$J=1 \rightarrow 2$	$\text{Si}^{30}\text{H}_3\text{Br}^{81}$	24720.57	203.63		4120.09
	$\text{Si}^{28}\text{H}_3\text{Br}^{79}$	17287.30	194.12		4321.82
	$\text{Si}^{28}\text{H}_3\text{Br}^{81}$	17170.45	195.44		4292.61

The theoretical hyperfine structure to be expected for a nuclear spin of 3/2 for beomine was in excellent agreement with the observed spectra for all the transitions involving Si^{28} . Since the second order quadrupole corrections were of the same order as the experimental error in frequency measurement (± 0.08 mc/s), they were neglected. These measurements yield a ratio of 1.209 for the nuclear quadrupole moment of Br^{79} to that of Br^{81} which compares favorably with the figure of 1.197 for the corresponding methyl bromides.¹ Any possible quadrupole effect due to the Si^{29} or Si^{30} nuclei was sufficiently small as to be within the limits of resolution.

The experimental determination of six effective moments of inertia resulting from the different isotopic species permits the evaluation of the three structural parameters of the molecule.

These were evaluated from the $J=2 \rightarrow J=3$ transitions of $\text{Si}^{28}\text{H}_3\text{Br}^{79}$, $\text{Si}^{28}\text{H}_3\text{Br}^{81}$, and $\text{Si}^{30}\text{H}_3\text{Br}^{79}$ and checked against the remaining three. The values are listed together with the estimated errors in Table II.

TABLE II. Structural parameters for bromosilane and chlorosilane.

	SiH_3Br	Covalent radii and tetrahedral angle	SiH_3Cl^2	Covalent radii and tetrahedral angle
Si-Br Distance	$2.209 \pm 0.001\text{A}$	2.31	2.048A	2.16
Si-H Distance	$1.57 \pm 0.03\text{A}$	1.47	1.50A	1.47
H-Si-H Distance	$111^\circ 20' \pm 1^\circ$	$109^\circ 28'$	$110^\circ 57'$	$109^\circ 28'$

As observed with SiH_3Cl , there is considerable shortening of the Si-Br distance from the sum of the covalent radii, presumably due to appreciable double bond character of this bond. However, the difference of the Si-Cl and the Si-Br distances is the same as that of the corresponding covalent radii. Although not stated explicitly,² the number of significant figures available in the chlorosilane parameters may be expected to be the same as that in bromosilane; hence differences in these parameters listed in Table II are not necessarily real.

We wish to thank Dr. A. E. Newkirk of this laboratory for the preparation of the bromosilane used in these measurements.

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¹ Gordy, Simmons, and Smith, Phys. Rev. **74**, 243 (1948).

² Computed from microwave measurements. See Daley, Mays, and Townes, Phys. Rev. **76**, 136 (1949), and A. H. Sharbaugh, Phys. Rev. **74**, 1870 (1948).

Erratum: The Application of Dyson's Methods to Meson Interactions

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IN Eq. (6) the closures of the brackets in the factors of the form $P(\dots)$ should follow the factor $j(x_n)$ in the first two terms and the factor $(j_\rho(x_{n-1})n_\rho(x_{n-1}))^2$ in the final term.

On the Photoelectron Spectrum of Ta¹⁸²

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A STUDY of the internal conversion electrons produced by the gamma-rays from the disintegration of Ta^{182} has led to a report¹ of some 28 gamma-rays in the energy range below 330 kev. The investigation herein reported is a study of the photoelectron spectrum of this isotope using a 14-cm radius of curvature uniform field spectrometer.² The only other reported investigation³ of the photoelectron spectrum of this isotope gives only two gamma-rays in the above-mentioned region and two higher energy gammas at 1.13 and 1.22 Mev.

The region for gamma-ray energies below 330 kev was studied using both uranium and lead radiators, each of 50 mg/cm² thickness and the results are indicated in Parts (A) and (B) of Fig. 1, respectively. The higher energy region was studied only with the uranium radiator and the result is shown in Part (C) of Fig. 1.