literature might require some reinterpretation. A search will be made in a future rocket for an upward intensity.

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Inversion Spectrum of Ammonia*

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PRECISION measurements of frequencies of some of the lines of the ammonia inversion spectrum in the microwave region have been made. Previous measurements[1–3] have been limited in accuracy to two to five mc/s. By the use of a 50 kc/s standard crystal, we believe that the present measurements are good to at least ±50 kc/s. Because of their intensity these lines may well be useful as secondary frequency standards.

There has also been considerable interest[1–3] in obtaining a function to describe these frequencies in terms of the rotational angular momenta. We have calculated the constants in such a function with parameters, J, the total angular momentum quantum number, and K, the angular momentum quantum number referring to the symmetry axis, in the form suggested by the paper[4] of H. Y. Sheng, E. F. Barker, and D. M. Dennison. The form of this function which we have found convenient for calculation is as follows:

TABLE I. Ammonia inversion spectrum.

J	K	Observed frequency	Calculated frequency	Calculated minus observed frequency
1	1	23,694.48±.05 mc/s	23,694.38 mc/s	−0.10 mc/s
2	2	23,722.59	23,722.43	−0.16
3	3	23,870.09	23,870.07	−0.02
4	4	24,139.38	24,138.83	−0.55
5	5	24,532.90	24,532.18	−0.72
6	6	25,056.06	25,055.16	−0.90
7	7	25,715.11	25,713.90	−1.21
2	1	23,098.78	23,098.87	+0.09
3	2	22,834.02	22,834.17	+0.15
4	3	22,683.73	22,686.40	+2.67
5	4	22,653.00	22,652.81	−0.19
6	5	22,732.47	22,732.14	−0.33
7	6	22,924.88	22,924.64	−0.24
8	7	23,232.16	23,232.07	−0.09
9	8	23,657.44	23,657.76	+0.32
10	9	24,205.20	24,206.93	+1.73
3	1	22,234.49	22,234.39	−0.10
4	2	21,703.32	21,702.95	−0.37
5	3	21,285.32	21,291.75	+6.43
6	4	20,994.63	20,993.91	−0.72
7	5	20,804.76	20,804.14	−0.62
8	6	20,719.19	20,718.57	−0.62
9	7	20,735.47	20,734.77	−0.70
10	8	20,852.50	20,851.60	−0.90
11	9	21,070.76	21,069.30	−1.46
12	10	21,391.55	21,389.50	−2.05
4	1	21,134.46	21,133.55	−0.91
5	2	20,371.51	20,370.23	−1.28
6	3	19,757.55	19,735.12	−22.43
7	4	19,218.52	19,217.73	−0.79

$\nu=\nu_0 \exp(\gamma/\nu_0)+\delta,$
$\nu=$frequency in mc/s,
$\nu_0=23{,}785.75$ mc/s,
$\gamma=-151.450(J^2+J-K^2)+59.892K^2$ mc/s,
$\delta=0.01353(J^2+J-K^2)^2+0.00461K^2(J^2+J-K^2)-0.00986K^4$ mc/s.

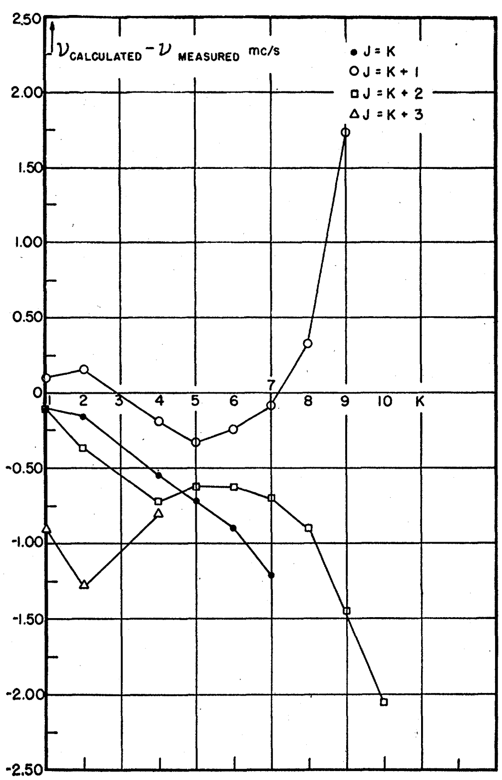

FIG. 1.

The data are given in terms of frequency since this is our fundamental unit of measurement. The measured and calculated frequencies are given in Table I.

The deviations from the calculated curve are plotted in Fig. 1, excluding the data for the $K=3$ lines, since these lines have apparently an anomalous behavior. These deviation curves are quite regular except for $K=3$ lines. Our formula for the frequency of these lines allows us to predict quite accurately, making use of the deviation curves, the anomalous deviations that appear on the $K=3$ lines, and the values are tabulated against the total angular momentum quantum number in Table II. It should be noted that there is no apparent shift of the $K=6$ and $K=9$ lines, from a fairly smooth curve. There are no $K=0$ transitions in this inversion spectrum.

TABLE II. Anomalous frequency shift in $K=3$ lines.

J	K	$\nu_{\text{measured}}-\nu_{\text{predicted}}$
3	3	−.32 mc/s
4	3	−2.69
5	3	−6.96
6	3	+21.39

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