Table I. *Change in the number of observed counts (chiefly Li disintegrations) and in the absorption of Cd as the temperature was lowered to about 95°K.*

Run	Change in Li disintegrations	Change in Cd absorption
	Source at H_2O temperature,	95–373°K
1	+7.8%	+ 2.6%
2	+4.1	+10.7
3	+8.9	+ 2.7
	Source at constant temperature,	H_2O 95–273°K
4	−1.46	+ 3.8
5	−2.8	+ 2.4
	H_2O at constant temperature,	Source 95–273°K
	+3 to 8.6%	

group. Runs 1 and 2 consisted of about 5000 to 7000 counts on each point, run 3 of about 10,000 to 12,000 counts, and runs 4 and 5 of about 12,000 to 20,000 counts on each point. The last two are considered the most reliable, in which cases the accuracy from a purely statistical standpoint should be better than ±1.5 percent.

In regard to the change in the total number of counts observed at the various temperatures as shown in column 2, various factors such as the obvious effect of the condensation of the radon in runs 1, 2 and 3, the possible increased absorption in the walls of the all Li chamber, or the possibility of a slight amount of frost, and other factors which cannot be described in detail here, will have to be taken into account before giving significance to these changes in the total observed count.

The change in the absorption of Cd, as tested by introducing a sheet of about 0.005 cm of Cd (sufficient to absorb about 50 percent of the slow neutrons) is a test of the properties of the neutrons which should be unaffected by factors that may change the number of neutrons. The results, Table I, indicate that the "cold" neutrons are slightly more easily absorbed by Cd. While the effect is small—of the order of 5 percent, it is considerably larger than the probable error, and the possibility of the apparent consistency of the 5 runs being fortuitous is very small. A number of interpretations can be made of these results, such as: (1) No large fraction of these slow neutrons are actually in thermal equilibrium; or (2) a considerable fraction of these neutrons may be in thermal equilibrium, but the absorption of Cd, and the disintegration of Li are not sensitive functions of the neutron energy in this region; or (3) such possible effects as the removal of the slower neutrons from the beam by combination with H or O, or the possibility that the Li detection region does not extend down to near zero energy, etc. may influence the results. The fact that the absorption curve of Cd, when measured with a reasonably parallel beam of slow neutrons, is very nearly exponential, seems to show that the absorption of Cd is not a sensitive function of the energy in this region, and hence that the temperature effect should be small.

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[1] Dunning, Pegram, Fink and Mitchell, Phys. Rev. **47**, 796 (1935).

The Raman Effect in Solutions of Magnesium Sulphate of Varying Concentrations

Previous experiments upon the Raman spectrum of magnesium sulphate have been reported. Embirokos[1] working in Gerlach's laboratory found a frequency shift of 985.7 cm^{-1} in a one-normal solution and 995.7 cm^{-1} in a two-normal solution. The magnitude of the shift was reported verified by Hollaender and Williams,[2] but Woodward and Horner[3] found no change in the frequency shift for solutions of different concentrations. Their values were 982 cm^{-1} for 1.25 and 2.55 normal solutions and 981 cm^{-1} for 5.1 normal. The frequency shift has been remeasured here for solutions of 4.5, 2.3, and 1.1 normal concentrations. The source of light was a glass mercury arc, the spectrograph a Hilger D78, and the plates were measured on a Hilger measuring micrometer. Several plates were taken for each concentration. The strong Raman line excited by Hg 4358A was used for measuring, and for the 4.5 normal solution also the line excited by Hg 4047A. The values found for the shift were 978.9±0.9 cm^{-1}, 980.5 cm^{-1}, 978.1 cm^{-1}. As the individual values for the 1.1 and 2.3 normal solutions lay between the extremes for the 4.5 normal, it is concluded that any change of frequency due to varying concentration must be not more than one or two wave numbers. This is in general agreement with the results of Woodward and Horner.

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May 17, 1935.

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[1] Embirokos, Zeits. f. Physik **65**, 266 (1930).

[2] Hollaender and Williams, Phys. Rev. **38**, 1739 (1931).

[3] Woodward and Horner, Proc. Roy. Soc. **A144**, 129 (1934).

Temperature Coefficient of the Work Function for Composite Surfaces

At the Washington Meeting, April 27, results were presented of an analysis of the field dependence of the slopes of Richardson plots for electron emission from thoriated tungsten based on a patch distribution of adsorbed atoms. This analysis was sufficient both to account for the experimental results and to establish the patch theory as the most probable explanation. The analysis did not account for the marked decrease of the intercept with increasing applied field, this departure of the intercept from its universal value being a measure of the temperature coefficient of the work function. It was suggested by J. A. Becker that this distribution of patches should also be a function of the temperature. If we let the concentration difference between patches vary with the temperature, we arrive at the following results:

(1) The temperature dependent patch distribution theory accounts for the field dependence of both the slope and intercept of the Richardson plot.

(2) In general, the temperature coefficient of the work function may be resolved into four parts, due, respectively to: (a) the base metal; (b) the uniform layer of adsorbed

atoms; (c) the variation of the distribution of adsorbed atoms; (d) the variation of local fields. Items (c) and (d) are related and are characteristic of the patch distribution.

(3) The sum of (a) and (b) constitute the temperature coefficient at zero applied field.

(4) At applied fields less than the local patch fields at the surface, actual measurement yields the sum of (a), (b), (c) and (d), (d) being a function of the applied field.

(5) At applied fields greater than the local patch fields at the surface, actual measurement yields the sum of (a), (b) and (c).

The temperature coefficient of the work function for composite surfaces has been measured, thermionically, calorimetrically and photoelectrically. To compare any of these reported values it is necessary that not only the applied fields but also the average size and concentration difference of the patches be the same

A detailed analysis of the observed thermionic constants will appear soon.

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