Rb. Kuhn[13] has also observed bands on the violet side of the second doublet of the principal series of Cs and some bands for K and Na. In view of these band-like structures and non-uniform plate characteristics the ascertainment of the presence of asymmetry was rather difficult. It is very likely, as the plates showed, that asymmetry sets in at about $p=10$ mm Hg, namely a violet and red asymmetry for the $^2P_{3/2}$ and $^2P_{1/2}$ components, respectively.

4. Theory *vs.* Experiment

According to Weiskopf,[14] Margenau and Watson,[15] Furrsow and Wlassow,[16] and Houston,[17] we have the following theoretical dependence of γ on N for Cs.

W	$10^7\,\gamma_1=0.37N$	$10^7\,\gamma_2=0.20N$
M & W	$=0.79N$	$=0.42N$
F & W	$=1.32N$	$=0.69N$
H	$=0.71N$	$=0.71N$

as compared with the results of measurements $10^7\,\gamma_1=1.45N$, $10^7\,\gamma_2=0.84N$. Thus it appears that the F & W formulae are more consistent with the results than the others.

On the basis of prior work on Na,[2] K,[1] and Rb[3] we can construct Table II in which the values in parentheses are those predicted by Houston.[17] The disagreement seems to be most in the case of K. The majority of results shows that the ratio γ_1/γ_2 is not unity. If we do not include the results for K the table indicates an increase in the ratio γ_1/γ_2 with principle quantum number: 0.2 per quantum number.

I wish to express my gratitude to Professor Bowen for many helpful suggestions and guidance and to Professor Houston for having so kindly discussed the theoretical aspects of the problem.

[13] H. Kuhn, Zeits. f. Physik **76**, 782 (1932).
[14] V. Weiskopf, Zeits. f. Physik **75**, 287 (1932).
[15] H. Margenau and W. W. Watson, Rev. Mod. Phys. **8**, 28 (1936).
[16] Furrsow and Wlassow, Physik. Zeits. d. Sowjetunion **10**, 378 (1936).
[17] W. V. Houston, Phys. Rev. **54**, 888 (1938).

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Resonance Absorption of Neutrons in Rhodium, Antimony, and Gold

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The following experiments were performed on the resonance neutrons of Rh, Sb^{121}, and Au: absorption in the element itself, absorption in boron, measurement of the total activation in an extended volume of hydrogenous material. The constants evaluated are the resonance energy E_r, the absorption coefficient for self-indication K_r, and the level width Γ. We found: for rhodium, $\Gamma=0.16$ ev; for antimony, $E_r=14$ ev, $K_r=4$ cm²/g, $\Gamma=0.8$ ev; for gold, $E_r=2.6$ ev, $K_r=40$ cm²/g, $\Gamma=0.11$ ev. In antimony and gold, the measurements indicate that a small fraction of the resonance activity induced in thin detectors is due to levels of higher energy. The observed absorption coefficient for thermal neutrons K_{th} in rhodium and gold is found to agree with the one calculated from the Breit and Wigner formula, by taking into account only the resonance level observed. In Sb, the calculated K_{th} is about six times larger than the one observed, which suggests the interference effect of negative levels.

INTRODUCTION

THE resonance absorption of slow neutrons affords the best means of investigating the position and width of nuclear levels. A considerable amount of data are already available for the few elements in which the intensity of the activity produced by slow neutrons and the convenient length of the decay period make the investigation practicable. Among the few suitable activities that have not been thoroughly investigated, there appear to be left the 2.8-day activity due to Sb^{122} and the 2.7-day activity due to Au^{198}. These

are both strong, and the length of the period affords the possibility of accurate measurements. The evaluation of some of the data on antimony and gold required a re-determination of some constants referring to the rhodium 44-second activity.

The sections of this paper describe: (1) absorption measurements for self-indication; (2) measurement of the resonance energy by the boron absorption method; (3) determination of the width of the levels from the total activation; (4) comparison of the observed data with the theoretical one-level formula of Breit and Wigner.

ABSORPTION OF RESONANCE RADIATION

In all of the measurements we employed a neutron source consisting of 250 mg of radium mixed with beryllium powder, contained in a cylinder of 14-mm outside diameter and 25-mm length.

The source was placed at the center of a paraffin cylinder of 8-cm thickness and 20-cm diameter. Care was taken to insure the exact symmetry of the source with respect to the two faces of the cylinder, so that the activities of two identical detectors could be compared by irradiating one on each side of the cylinder. This arrangement was used for the boron absorption measurement.

Absorption curves for self-indication were obtained by irradiating a stack of identical foils simultaneously and then measuring their respective activities. The detectors were placed between two cadmium sheets sufficiently thick to absorb all neutrons of thermal energy. The detectors were sometimes placed in contact with the paraffin and, at other times, at a distance of 6 cm from the surface of the paraffin in order to obtain an approximately parallel beam of neutrons. In this latter arrangement, the effective diameter of the neutron beam was reduced to 3.5 cm by means of heavy boron carbide shields. Further shields limited the angle under which the neutrons could strike the detector to 30 degrees, and hence obliquity corrections were neglected.

All activities were measured by means of a Pyrex glass counter, whose wall thickness was optically measured and found to be 0.14 mm. The cathode consisted of a coil of copper wire in contact with the counter wall. The outside of the counter was silvered and connected to the cathode in order to maintain both at the same potential. Scaling circuits of 2 and 4 were used when required by the strength of the activity.

TABLE I. Self-indication curve for antimony.

Thickness of absorber in mg/cm²	Percentage transmission
0	100
10.6	91.7
21.2	86.8
31.8	80.8
42.4	75.0

The activities obtained by irradiation with the parallel neutron beam were so weak that the detectors had to be placed as close as possible to the counter. To accomplish this, the activated foil was pasted on the inside of a brass tube which could be placed in an exactly reproducible position with respect to the counter. When the irradiation was performed on the surface of the paraffin, the activities were strong enough to make the above procedure unnecessary, and the detectors were held in a rectangular holder fixed close to the counter. The standard procedure of measuring the long-lived activities was to take the number of counts during twenty minutes for each detector. As a rule, 10 such readings were taken for each detector, corrections being made for the decay.

The antimony detectors were made by electrolytic deposition on nickel foil of 0.1 g/cm². The amount of antimony deposited was checked by weighing the foils before and after deposition. The foils contained 10.6 mg/cm² of Sb^{121}, and were cut to a standard size of 3×3 cm². They were identical to within one percent; nevertheless, the self-indication absorption curve was repeated three times, by interchanging the order of the foils. A correction was made for the scattering of the nickel support, by assuming that the scattering cross section of the nickel nucleus[1] is 13×10^{-24} cm², and that only half of the cross section is effective, because the measurements were performed close to the surface of the paraffin.

The percentage activities of the five successive

[1] M. D. Whitaker and W. C. Bright, Phys. Rev. **60**, 155 (1941).

foils used, corrected for the factors previously mentioned, are given in Table I.

The mass absorption coefficient for resonance radiation K_r (which is one-half of the value at exact resonance), was obtained by making the experimental points fit the self-indication curve given by Bethe[2] for the case of Fermi angular distribution of the neutrons. No correction was required for the thickness of the detectors, since each foil absorbed only about 6 percent of the resonance radiation. A good agreement between the experimental points and the theoretical curve was obtained by assuming $K_r=4$, when referred to the isotope Sb^{121}. This agreement, however, does not necessarily imply that only one level is effective.

For the measurements on gold, we used foils 2.5×2.5 cm^2 in size, and 13.5 mg/cm^2 in thickness. An absorption curve for self-indication was first obtained by irradiating the foils on the surface of the paraffin. In order to compare the experimental points with the theoretical curve previously mentioned, a correction had to be applied for the finite thickness of the detectors. This was done by a method similar to the one described by Hornbostel, Goldsmith and Manley.[3] We obtained a good agreement with the theoretical curve, when we assume $K_r=33$. Frisch,[4] who used an approximately parallel beam, found $K_r=40$. This discrepancy induced us to repeat the measurements with our parallel beam arrangement. Under these conditions, we found that the experimental points did not fit the theoretical curve, but instead showed a flattening out with increasing absorption, indicating that the activity is due to more than one level. This observation is interesting, because it shows how easily the inhomogeneity of the activating neutrons can be masked by the effect of obliquity. By subtracting from the activity of each foil a constant amount (about 12 percent of the activity of the first foil), assumed to be due to penetrating neutrons, one can make the experimental points fit the theoretical curve with $K_r=$ of the order of 40. This procedure, however, is somewhat arbitrary. The only permissible conclusion is that detectors of the thickness used are mainly activated through one resonance level, but the effect of other levels is not negligible. This conclusion is confirmed by the boron absorption measurements, to be discussed in the next section.

[2] H. A. Bethe, Rev. Mod. Phys. **9**, 146–147 (1937).
[3] J. Hornbostel, H. H. Goldsmith, and J. A. Manley, Phys. Rev. **58**, 18 (1940).
[4] O. R. Frisch, Danske Vid. Selsk. **14**, 12 (1937).

BORON ABSORPTION MEASUREMENTS

In these measurements we irradiated simultaneously two identical detectors placed in symmetrical positions with respect to the source and the paraffin block. The irradiation with cadmium-filtered neutrons took place at 6 cm from the paraffin, when the arrangement already described was used. The equality of the two beams was checked to within about one percent by using strongly activated detectors.

A boron absorber was placed in front of one of the detectors, and the ratio of the two activities was measured. The boron absorbers were made by allowing a suspension of boron carbide (400-mesh size) in alcohol to settle in an aluminum tray of 5×5 cm^2. The dried powder was then compressed in the form of a package, care being taken to insure uniform thickness.

In order to determine the energy of the resonance neutrons, one has to measure the ratio of the absorption coefficients in boron for these neutrons and for those of thermal energy. Since the boron content of our absorbers may be doubtful, we redetermined the absorption coefficient of boron for thermal neutrons with the same absorbers. This verification was performed with a parallel beam of thermal neutrons produced by a paraffin howitzer and a boron trifluoride ionization chamber connected to a linear amplifier.

If the boron content of the boron carbide is assumed to correspond to the formula B_4C, our measurements gave a mass absorption coefficient of 28 cm^2/g for neutrons of energy kT at room temperature. Measurements made with Pyrex glass plates gave the same result, if we take 20 percent as the B_2O_3 content of Pyrex. It may be noted that there is a certain amount of disagreement in the values of the absorption coefficient given in the literature. Our value agrees with the results of Frisch,[4] Goldsmith and Rasetti,[5] and Fink,[6] whereas somewhat higher values were ob-

[5] H. H. Goldsmith and F. Rasetti, Phys. Rev. **50**, 328 (1936).
[6] G. A. Fink, Phys. Rev. **50**, 738 (1936).

tained by Amaldi and Fermi,[7] and by Weekes, Livingston, and Bethe.[8] In any case, the absolute values of the absorption coefficients are immaterial, since both the coefficients, for resonance and thermal neutrons, were measured with the same absorbers.

In order to test the homogeneity of the activating radiation, sometimes two detectors D_1 and D_2 of the same element were placed one on each side of the paraffin, and two respectively

TABLE II. Activity of a thin rhodium detector in water.

Distance from the source	Thermal+resonance neutrons	Resonance neutrons
7.5 cm	112	67
10. cm	60	31

identical detectors D'_1 and D'_2, on the other side. If B represents the boron absorber, then we have the following arrangement: D_1, D_2 on one side, and B, D'_1, D'_2 on the other. Thus the ratio of the activities of D_1 and D'_1 gives the absorption coefficient in boron for the neutrons that are most strongly absorbed in the detectors, while D_2 and D'_2 give the absorption coefficient in boron for the neutrons that have been filtered by the element itself. If the activation is owing to one narrow level, the two coefficients should be equal. On the other hand, if there exist several levels widely separated in energy, the second absorption coefficient will be considerably smaller than the first.

For antimony, we used detectors D_1 and D'_1 of 67 mg/cm^2, and D_2 and D'_2 of 112 mg/cm^2, referred to Sb^{121}. The boron absorber contained 313 mg/cm^2 of boron. As the average of several measurements, we found the following mass absorption coefficients in boron: unfiltered neutrons, 1.32 cm^2/g; filtered neutrons, 1.08 cm^2/g.

The values indicate the existence of two or more levels which, however, do not seem to be widely separated in energy.

The effective energy of the neutrons activating a detector of 67 mg/cm^2, after a small correction for scattering of the neutrons in boron[9] is applied, was found to be 14 ev, while the filtered neutrons activating the thicker detector showed an average energy of 22 ev.

For gold, we used detectors D_1 and D'_1 of 20 mg/cm^2, and D_2 and D'_2 of 40 mg/cm^2. The absorption coefficients in boron were: unfiltered neutrons, 2.9 cm^2/g; filtered neutrons, 2.3 cm^2/g.

These coefficients correspond, respectively, to average energies of 2.6 ev and 4.3 ev. These results confirm the conclusion about the inhomogeneity of the gold resonance neutrons, deduced from the self-indication measurements. This fact seems to have escaped the observation of previous experimenters.

MEASUREMENT OF LEVEL WIDTH BY THE METHOD OF INTEGRATED ACTIVITY

The width Γ of a neutron resonance level can be determined by measuring the activation of a detector under neutron irradiation of known intensity. This can be best accomplished by taking, for a thin detector, the ratio Y of the activities respectively induced by resonance and thermal neutrons, these activities being integrated over an infinite volume of water containing the neutron source. The details of this method are fully explained by Amaldi and Fermi,[7] and Bethe.[10] The width Γ is given by the formula

$$\frac{\Gamma}{E_r} = Y\frac{K_{\text{th}}}{K_r}\frac{3\frac{1}{2}L}{\pi l_0},$$

where K_{th} and K_r are, respectively, the absorption coefficients for thermal and resonance neutrons in the detector, $L=2.4$ cm is the average diffusion length of thermal neutrons in water,[11] $l_0=0.65$ cm, the mean free path[12] of resonance neutrons for elastic impacts in water, and E_r is the energy of the resonance neutrons.

This type of measurement has already been performed for rhodium by Amaldi and Fermi.[7] These observers used a thick detector, and therefore we felt it advisable to repeat the measurements with a detector of 2.54 mg/cm^2, which may be considered as thin both with respect to thermal and resonance neutrons. This detector was made by electrochemical deposition of

[7] E. Amaldi and E. Fermi, Phys. Rev. **50**, 899 (1936).
[8] D. F. Weekes, M. S. Livingston, and H. A. Bethe, Phys. Rev. **49**, 471 (1936).
[9] Bethe, reference 2, p. 136.
[10] Bethe, reference 2, p. 141.
[11] Bethe, reference 2, data corrected according to O. R. Frisch, H. v. Halban, and J. Koch, Danske Vid. Selsk. **15**, 10 (1938); H. B. Hanstein, Phys. Rev. **59**, 489 (1941).
[12] H. B. Hanstein, Phys. Rev. **59**, 489 (1941).

rhodium on copper foil. We found that the 5-minute activity of the copper support was not negligible; so the rhodium deposit was transferred onto an inactive support. The rhodium was cemented to a piece of pure tin sheet by means of a thin layer of Apiezon W wax. The copper was then dissolved in nitric acid, leaving the rhodium free from any activable element. The antimony and gold detectors were also cemented to similar tin sheets, to insure identical conditions.

A cadmium sheet of dimensions large compared to the mean diffusion length of thermal neutrons was placed near the center of a large water tank, and the neutron source was located in the plane of the cadmium sheet. The rhodium detector rested on the cadmium sheet and was irradiated in two positions, at 7.5- and 10-cm average distance from the source. The measurements were repeated with the detector covered with another sheet of cadmium, and hence the effect of thermal and resonance neutrons could be separately evaluated. The activity was measured for one minute, starting 15 seconds after an irradiation of one minute, and each reading was repeated ten times.

The relative activities, corrected for counter background, are the following:

Measurements at larger distances from the source were not performed because of the weakness of the activity. Therefore, the two points obtained were made to fit Amaldi and Fermi's curves for thick detectors. This gave the value $Y=1.22$. If we set[3] $K_{\text{th}}=0.80$, and $K_r=11.5$, Γ/E_r becomes 0.16. If we assume[13] $E_r=1.0$ ev, Γ becomes 0.16 ev.

Measurements with thick detectors introduce an error in the ratio of the areas of the two curves, but do not alter their shape; hence our use of Amaldi and Fermi's curves is legitimate.

The same method was used to determine the absolute width of the gold level. We irradiated four gold foils, 20 mg/cm^2 thick and 2.5×2.5 cm^2 in area, shielded with cadmium on both sides, in the water tank at average distances of 6, 11, 16, and 21 cm from the source. A fifth identical foil was irradiated at 6 cm from the source, shielded with cadmium on one side only. The relative activities are given in Table III.

For the resonance neutrons, we multiplied the activities by r^2, and plotted these values against the distance r. The curve did not differ to any considerable extent from the ones given by Amaldi and Fermi[7] for neutrons activating silver or rhodium. For thermal neutrons, we determined only one point, because the shape of the curve is accurately known from the work of Frisch, von Halban, and Koch.[14] A graphical evaluation of the areas under these two curves gave the ratio $Y'=1.45$. To deduce the true value of Y, a correction must be applied for the thickness of the detector. It can readily be seen[15] that the measured value Y' must be divided by the expression

$$f=\frac{1}{K_r\delta}\int_0^1 xdx\int_0^{K_r\delta/x} J_0(iy)e^{-y}dy,$$

where J_0 is the Bessel function of order zero.

In our case, $\delta K_r=0.8$, and a numerical integration gave $f=0.52$. Hence $Y=2.8$, and $\Gamma/E_r=0.038$.

Since the use of thick detectors and correction factors might be open to objection, we found it advisable to re-determine this value by using thin detectors of 1.42 mg/cm^2. Two foils were irradiated at 6 cm from the source, as only the activity close to the source was measurable. The ratio of the activities due to resonance and thermal neutrons was found to be 4.0, which, if the same curves are used as before, gives the same value of Y.

TABLE III. Activity of gold in water as function of distance from the source.

Distance r, cm	Resonance + thermal neutrons	Resonance neutrons
6	231	156
11		38
16		10
21		2.8

These measurements on gold were performed

[13] C. P. Baker and R. F. Bacher, Phys. Rev. **59**, 332 (1941).

[14] O. R. Frisch, H. v. Halban, and J. Koch, Danske Vid. Selsk. **15**, 10 (1938).

[15] See Bethe, reference 2, p. 148, formula (543), integrated by placing $x=\cos\vartheta$ and omitting the second term, since, inside the hydrogenous medium, the neutrons fall on the detector with a cosine distribution.

as a check on the results obtained by another method of measuring the width, to be described in the next section.

MEASUREMENT OF RELATIVE LEVEL WIDTHS

Another procedure for measuring the width of a neutron resonance level consists in taking as standard the level of an element whose width has already been measured. This requires only one measurement of the activity in an arbitrary position with respect to the hydrogenous material, provided that the activation of the standard element be measured in the same position. If A_1 and A_2 represent the activities of the two elements, K_1 and K_2 their respective absorption coefficients for resonance neutrons, δ_1 and δ_2 the respective thicknesses, and E_1 and E_2 the resonance energies, the ratio of the widths Γ_1 and Γ_2 is given by

$$\frac{\Gamma_1}{\Gamma_2}=\frac{E_1}{E_2}\frac{A_1}{A_2}\frac{K_2}{K_1}\frac{\delta_2}{\delta_1}.$$

We therefore measured the activities of thin detectors of rhodium, antimony, and gold, all 5×5 cm^2, irradiated on the surface of the above described paraffin block. Each detector was irradiated both with unfiltered and cadmium-filtered neutrons. The measured activities were corrected for the finite time of irradiation, the decay, and the absorption of the electrons in the counter walls. No corrections were needed for counter sensitivity, since this was found to be constant by checking with a uranium standard. The results are summarized in Table IV.

The activity induced by thermal neutrons in Sb was used by us to determine K_{th} for Sb, by referring it to the activity induced by thermal neutrons in rhodium. We found $K_{th}=0.023$, corresponding to $\sigma=4.7\times10^{-24}$ cm^2, in satisfactory agreement with the data of Rasetti[16] and Goldhaber and O'Neal.[17]

The widths of the Sb and Au levels were calculated by assuming: for antimony, $E_r=14$ ev, $K_r=4.0$; for gold, $E_r=2.6$ ev, and $K_r=40$.

The correction for absorption in the counter walls was deduced directly from the absorption coefficient of the electrons, for rhodium and antimony. The error committed cannot be large, since the average energies of the electrons emitted by these two elements do not differ considerably, and moreover the correction factor is small. In the case of gold, where the electrons are very soft, we preferred to adopt the following procedure. The activities induced in rhodium and gold by thermal neutrons should be proportional to the respective capture cross sections, since the detectors are thin. We found that the activity of gold had to be multiplied by the factor 2.9, to bring it into agreement with the activity of rhodium, corrected for counter absorption. Consequently we multiplied the activity due to resonance neutrons in gold by the same factor.

The value of K_{th} for rhodium was checked using a parallel neutron beam and a boron trifluoride ionization chamber. We found $K_{th}=0.80$ cm^2/g, in good agreement with the value given by Fink.[6] A reduction of 10 percent was applied to this value, to correct for the partial cross section corresponding to the 4-minute activity. K_{th} for gold was taken from Dunning, Pegram, Fink, and Mitchell.[18]

The measurements on the surface of the paraffin can also be used to calculate the widths by a method which does not require corrections for the electron absorption. For each element, we take the ratio Y' of the activities produced by resonance and thermal neutrons; these ratios are 0.81 for Rh, 3.1 for Sb, and 2.5 for Au. From the water tank experiments, we know that for Rh, $Y=1.22$. We may assume, to a first approximation, that the values of Y are proportional to the values of Y'. This would be exactly true if the resonance energies were the same for all elements, and will still be approximately true if the

TABLE IV. Relative activities of Rh, Sb, and Au irradiated on the surface of the paraffin.

Detector	δ mg/cm^2	Initial activity for infinite irradiation. Counts per minute Thermal	Res.	Initial activity corrected for counter absorption Thermal	Res.	Γ/E_r	Γ
Rh	2.54	284	231	344	280	0.16	0.16
Sb	10.7	28	93	39	128	0.057	0.8
Au	1.42	25	63	73	183	0.054	0.14

[16] F. Rasetti, Phys. Rev. **58**, 869 (1940).
[17] R. D. O'Neal and M. Goldhaber, Phys. Rev. **59**, 102 (1941).
[18] J. R. Dunning, G. B. Pegram, G. A. Fink, and D. P. Mitchell, Phys. Rev. **48**, 265 (1935).

energies are not considerably different. We thus get $Y=4.7$ for Sb, and 3.8 for Au. The corresponding relative widths Γ/E_r are 0.058 for Sb and 0.05 for Au.

It is gratifying that the values of the relative widths calculated by two different methods, for antimony, and by three different methods, for gold, agree as well as can be expected when the experimental errors involved in this type of measurement are considered. We thus feel reasonably certain that our values of the relative widths are essentially correct. As a weighted average of the relative width of the gold level, we take $\Gamma/E_r=0.042$, giving $\Gamma=0.11$ ev.

The level width Γ in every case is sufficiently large compared to the Doppler width Δ for the corresponding resonance energy to justify the neglection of the latter.[19]

For gold, this conclusion is in agreement with the negative result of an attempt to observe the Doppler effect directly through the variation with temperature of the absorption coefficient for resonance neutrons. Two gold foils of 20 mg/cm^2 were irradiated, one on top of the other, inside a Dewar flask imbedded in a paraffin block. The foils could be cooled by contact with a metal plate kept at liquid nitrogen temperature. The irradiation was performed both at room and at liquid nitrogen temperature, and the absorption coefficient in both cases was found to be the same, within the experimental error of one percent. From the curve given by Bethe and Placzek[17] for $\Gamma_{\text{eff}}/\Gamma$ as a function of Γ/Δ and our value of Γ, it can be seen that no measurable change could be expected.

CHECK OF THE ONE-LEVEL FORMULA

The dispersion formula of Breit and Wigner[20] shows that, when only one resonance level is responsible for the capture of neutrons of thermal energy, the absorption coefficient K_{th} is given by

$$K_{\text{th}}=K_r\frac{\pi^{\frac{1}{2}}\Gamma^2}{4E_r^{\frac{3}{2}}(kT)^{\frac{1}{2}}}.$$

Our measurements of Γ enable us to verify the validity of the one level formula by comparing the measured and calculated values of K_{th}. Table V summarizes the results. In the case of rhodium and gold, the agreement is excellent. Our value of Γ for Rh does not considerably differ from the one given by Hornbostel, Goldsmith, and Manley,[3] who deduced it by postulating the validity of the one-level formula. We believe that ours is the first direct determination of the width of the rhodium level with sufficiently thin detectors.

TABLE V. Observed and calculated values of K_{th}

Detector	Γ	K_{th} observed	K_{th} calculated
Rh	0.16	0.80	0.87
Sb^{121}	0.8	0.023	0.134
Au	0.11	0.27	0.32

In the case of antimony, the calculated cross section for thermal neutrons is much larger than the one observed. We must conclude that other levels interfere with the one responsible for the observed resonance activation. It is unlikely that levels at higher energies would have sufficient effect on K_{th} to reduce it to the low observed value, unless they contributed a large fraction of the activation due to nonthermal neutrons. The likeliest assumption is that the small value of K_{th} is due to the interference of a negative level.[21]

[19] H. A. Bethe and G. Placzek, Phys. Rev. **51**, 450 (1937).

[20] See Bethe, reference 2, formula (538).

[21] *Note added in proof.*—According to recent results of J. H. Manley, L. J. Haworth, and E. A. Luebke, Phys. Rev. **61**, 152 (1942), the mean diffusion length in water L would be 2.22 cm instead of 2.4 cm as used in this paper. This would make all the widths smaller by 8 percent.