in the light of Shoenberg's  $^{8}$  observation that molybdenum metal is itself nonsuperconducting down to 0.3°K.

Measurements on compounds of other transition metals together with details of preparations, analyses, and apparatus will be reported later.

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## The Beta-Spectrum of Cl<sup>36</sup>

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 $\mathbf{I}^{T}$  was pointed out by Longmire, Wu, and Townes<sup>1</sup> that the Fermi theory of beta-decay fails to account for the  $D_2$  shape of the Cl<sup>36</sup> beta-spectrum found by Wu and Feldman,<sup>2</sup> unless a mixture of interactions is assumed. The arguments were based upon the measured<sup>3</sup> spin of two for Cl<sup>36</sup>, and upon the assumption of a spin of zero for A<sup>36</sup>. It was shown that the observed spectrum could be accounted for by use of any one of three different mixtures of interactions: (2S, 2T); (2V, 2T); or (2V, 2A).

We have examined the Cl<sup>36</sup> beta-spectrum by use of a high pressure argon-filled proportional counter<sup>4</sup> and have obtained experimental results which disagree with those mentioned above.



FIG. 1. Corrected beta-spectrum of Cl<sup>34</sup>. Curve (a) was obtained by use of the  $C_2\tau$  correction factor, Curve (b) was obtained when the  $D_2$  correction factor was applied to the same data. The error symbols represent standard deviations. Resolving power corrections have been applied to the original data, but their chief effect is to raise the end point energy slightly. The average thickness of the finely divided KCl source used here was 1.2 mg/cm<sup>3</sup>. The backing was 0.2-mg/cm<sup>3</sup> Al foil.

The chief disagreement is at the low energy end of the spectrum, where we find fewer electrons, with the result that our points lie very near to a second forbidden tensor spectrum. (See Fig. 1.)

The 2T spectrum involves contributions from two different matrix elements. In the terminology of Longmire, Wu, and Townes.

 $C_{2T} = a(T_{ij}^2 \text{ shape}) + b(A_{ij}^2 \text{ shape}) - c(T_{ij}A_{ij} \text{ shape}),$ 

where a, b, and c are real numbers, with  $a \ge 0$ ,  $b \ge 0$ ,  $c^2 \le 4ab$ . We have found a fit for  $c^2 = 4ab$  and b = 25.73a. The quantities in parenthesis are defined exactly by Konopinski and Uhlenbeck.<sup>5</sup>

The initial experiment has been repeated six times over a period of six months, with the proportional counter operating under various conditions, and with source thicknesses varying from 0.2 mg/cm<sup>2</sup> to 5.0 mg/cm<sup>2</sup>; each of the distributions found agrees better with the 2T shape than with the  $D_2$  shape.

The samples of Cl<sup>36</sup> were obtained by a careful chemical separation of chlorine from an Oak Ridge irradiation unit of KCl. The KCl was treated with concentrated sulfuric acid, and the HCl given off was collected and reconverted into KCl. This procedure should be quite effective in separating chlorine from any radioactive impurity expected to be present. The chief radioactivity in the raw unit was S<sup>35</sup>. Traces of S<sup>35</sup> in the final sample could not have affected our results seriously, because of the low (170-kev) energy limit of the S35 beta-rays and because any ordinary radioactive impurity would have caused the intensity of the low energy end of the spectrum to be raised, not lowered.

Our method, although relatively new, has faithfully reproduced a number of known spectra such as those of Y<sup>91</sup> and Be<sup>10</sup>. (See Fig. 2.) (The Be<sup>10</sup> and Cl<sup>36</sup> spectra shown here were obtained within



FIG. 2. Corrected beta-spectrum of Be<sup>10</sup> for comparison with the Cl<sup>86</sup> spectrum. The plot of this  $D_2$  beta-spectrum is straight down to about 1.3 mc<sup>2</sup>. BeO crystalline source of average thickness about 1.9 mg/cm<sup>2</sup> on 0.2-mg/cm<sup>2</sup> Al ioil. Coulomb corrections have been applied to both spectra.

a few hours of each other under identical operating conditions.) We have acquired some confidence in its use, both from those results and from an analysis of its operation. A detailed description of the method will be published later.

We conclude that it may well be possible to account for the shape of the Cl<sup>36</sup> beta-spectrum by means of a single interaction, 2T (or 2V).

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