their errors. Essentially the same weights were obtained independently from a consideration of the line widths and rates of drift in the various runs. If we take into account the small uncertainties of \( g_J(K) \) and \( g_J(Cs) \) we obtain

\[
g_J(Cr) = 2(1.00081 \pm 0.00005).
\]

**DISCUSSION AND CONCLUSION**

Our measurements show that the ground state of Cr is a much "better" \( S \) state than was indicated by the less accurate optical value for \( g_J \). However, \( g_J(Cr) \) does differ by approximately 3 parts in \( 10^4 \) from \( g_J \), the pure electron spin \( g \) factor. This discrepancy can be due to several factors: (a) interaction terms in the radiative correction; (b) nonradiative relativistic correction; (c) diamagnetic correction, and (d) perturbations due to higher states. The effects (a) and (b) have been calculated for some spectra with one or two valence electrons and have been found to be much smaller than \( 3 \times 10^{-4} \). No calculations are available for Cr which has six valence electrons. The diamagnetic correction (c) is negligible \((-2 \times 10^{-4} \) for Cr). The deviation of \( g_J(Cr) \) from \( g_J \) that has been found is indeed in the direction to be expected from a perturbation (d), but no quantitative conclusions can be drawn until the corrections (a) and (b) are known.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 2B/A )</td>
<td>( g_J(K) / g_J )</td>
<td>( 2(1.000114 \pm 0.000001) )</td>
</tr>
<tr>
<td>Av of 2/CA and 2BDE/A</td>
<td>( g_J(Cs) / g_J )</td>
<td>( 2(1.00125 \pm 0.00003) )</td>
</tr>
</tbody>
</table>


We are much indebted to Dr. G. Herzberg for helpful criticism.

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**The 7.68-Mev State in C12**

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Magnetic analysis of the alpha-particle spectrum from \( N^4(d, p)C^{12} \) covering the excitation energy range from 4.4 to 9.2 Mev in \( C^{12} \) shows a level at 7.68\pm0.03 Mev. At \( E_d = 620 \) kev, \( \theta_{14A} = 90^\circ \), transitions to this state are only 6 percent of those to the level at 4.43 Mev.

SALPETER and Ópic have pointed out the importance of the \( Be^8(d, \gamma)C^{12} \) reaction in hot stars which have largely exhausted their central hydrogen. Hoyte explains the original formation of elements heavier than helium by this process and concludes from the observed cosmic abundance ratios of \( O^{16}, C^{12}:H^6 \)

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3 F. Hoyte (private communication).
Identification of this group as alpha particles was made by placing nuclear track plates in the focal plane of the spectrometer and measuring the range of these particles of known $\text{mev}/\text{e}$. To make certain that this weak group does not come from any likely contamination in the target, the measurements were repeated with targets of ice, carbon, and with the target warm. This group did not appear. It did appear with targets prepared from two different samples of ammonia, one of 99.98 percent purity according to the Mathiesson Company.

The energy of each group is taken to be that of the half-maximum point on the leading edge with an assigned uncertainty of ±one quarter of the full width of the rise. A more exact determination of the energy of these groups by fitting the curves to the theoretical thick-target spectrum shape is not worth while because of the poor statistical accuracy of the low-energy group. The energy scale was calibrated against the energy of the group to the 4.43-Mev state which was calculated from the MIT value\textsuperscript{8} for the $Q$ of this transition. The difference in energy of the two groups is 2.438±0.025 Mev, and using the value\textsuperscript{9} 4.431±0.013 for the first-excited state, we find the energy of excitation in C\textsuperscript{13} to be 7.68±0.03 Mev.

A limit can be set on the width of this state by an examination of the spectrum. The slope of the leading edge of the thick target spectrum is determined by the natural line width, the resolution of the spectrometer, and the energy spread $(\Delta E_0/\Delta E \cdot \Delta \theta$ introduced by the finite aperture $\Delta \theta$. The results in Fig. 1 were taken with very low resolution, $E/\Delta E=117$, in order to obtain the maximum counting rate for the weak group. With nuclear plates as detector it was possible to increase the resolution of the spectrometer so that it made a negligible contribution to the width of the leading edge. The width of the edge was then found to be 33 kev; the value calculated from $(\Delta E_0/\Delta \theta$ and the observed width of the edge for the high-energy group is 31 kev. This discrepancy is well within the limits of our experimental accuracy, and we conclude that this state has a natural width not noticeably greater than the width of the 4.43-Mev state. A width of 25 kev could have been detected. Thus the decay into Be\textsuperscript{8} and He\textsuperscript{4} with an energy of 0.31 Mev is apparently slowed down by the penetration factor which is indeed expected to be small.

We are indebted to Professor Hoyle for pointing out to us the astrophysical significance of this level.

\textsuperscript{1} Guier, Bertini, and Roberts, Phys. Rev. 85, 426 (1952).
\textsuperscript{3} Beghian, Halban, Husain, and Sanders, Phys. Rev. 90, 1129 (1953).