coincidence should be included. At 100–110 Mev for photographic emulsion nuclei this amounts to about 4 percent according to the work of Bernardini, Booth, and Lederman.[2] It is probably higher at higher energies and for lighter nuclei. On the other hand, there is a contribution from the elastic diffraction scattering which should be deducted. This is not large (about 5 percent) for lead but increases for the lighter nuclei and amounts to about 15 percent for carbon. These corrections have been applied in obtaining the absorption+inelastic scattering cross sections which are listed in columns 5 and 6. An appropriate increase in the assigned uncertainty is indicated there. The general result is that the observed total cross sections have the geometric values within the uncertainties (15 percent) of the present technique. Moreover, with the possible exception of carbon, there is no evident energy dependence over the range of energies (85 to 133 Mev) covered thus far.

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Spin Paramagnetism of Cr^{+++} at Liquid Helium Temperatures and High Magnetic Fields

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ANALYSIS of measurements of the magnetic moments of suitable paramagnetic salts, in the range where saturation effects are observed, makes possible a determination of the applicability of existing theories of paramagnetism. In particular, one can check ideas relating to magneton numbers and the quenching of orbital angular momentum, as well as examine the use of these ideas in the space-quantized model of the paramagnetic ion.

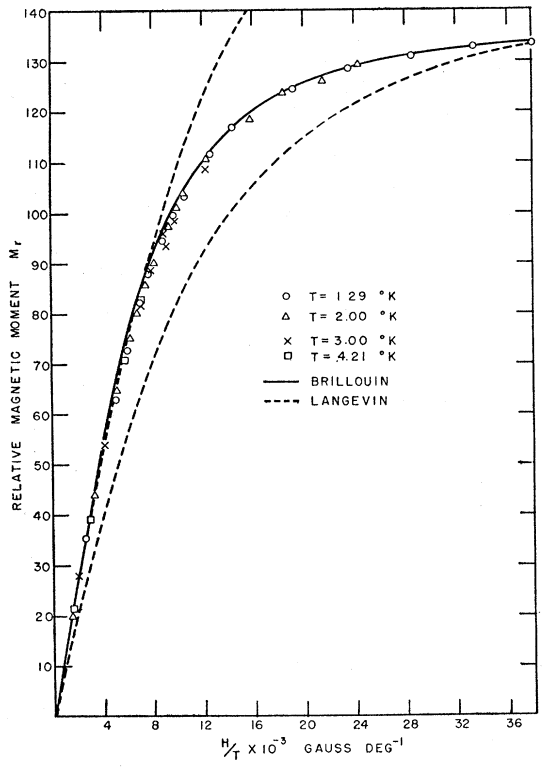

FIG. 1. Relative magnetic moment *vs* H/T for a solid sphere of potassium chromium alum. The Brillouin function (solid curve) is matched to the experimental moment at the largest value of H/T. For comparison, the Langevin function (broken line) is matched at the largest value of H/T to obtain the bottom curve while the slope is matched near the origin to obtain the top curve.

The magnetic moment of potassium chromium alum (which contains the trivalent chromium ion of spin $\frac{3}{2}$) has been previously measured at liquid helium temperatures in fields up to 19 kilogauss.[1] In the present study measurements are extended to 50 kilogauss, making it possible to carry out a more critical study of magnetic behavior near saturation. Relative magnetic moments of a spherical sample of the alum were measured with a double coil system. For fixed values of temperature and magnetic field, the sample was moved with respect to the coils; the resulting deflection of the ballistic galvanometer used being proportional to the magnetic moment of the sample. Relative moments were reproducible to ±0.2 percent and the ratios of magnetic field to absolute temperature were measured to an accuracy of ±1.5 percent. The results are given in Fig. 1.

Analysis of these data consisted of comparison, at given values of H/T, of ratios between calculated and measured moments. Perfect agreement would correspond to constancy of ratios. The Langevin formula did not fit the data (30 percent change in the ratio). However, good agreement (a total spread of about 3 percent over the range) was obtained by comparison with the space-quantized Brillouin model[2] based on the statistical distribution of possible orientations of the magnetic dipoles caused by the spin (the orbital momentum being quenched[3]). This gives for the magnetic moment

$$M=N\mu_B\left[(2S+1)\coth\frac{(2S+1)\mu_B H}{kT}-\coth\frac{\mu_B H}{kT}\right],$$

where N is the total number of ions, μ_B is the Bohr magneton, S is the spin, taken as $\frac{3}{2}$, k is the Boltzmann constant, H is the magnetic field, T is the absolute temperature, and g, the Lande-g factor, has been taken as 2 for $L=0$ instead of $\frac{2}{5}$ for $L=3$.

As can be seen from a comparison of experimental points and the Brillouin curve in Fig. 1, there is agreement for all temperatures used and for fields up to 50 kilogauss, where, for the lowest temperature used, a 99.5 percent saturation was achieved. The ideas of quenching and space quantization are not incompatible with the experimental results here obtained. A more detailed report of this study will be made later.

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Beta-Spectra of Cerium 144 and Praseodymium 144

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IN previous investigations of Ce^{144} and its daughter product Pr^{144} two beta-spectra were reported: one spectrum of Ce^{144} with upper energy limit 348 kev and a second of Pr^{144} with upper energy limit 3.07 Mev. In addition three monochromatic electron groups were observed.[1]

Recently the transitions in Pr^{144} were reinvestigated with a permanent magnet spectrograph, and gamma-rays of 80.0 kev, 134.0 kev, and some other less definite gamma-rays were observed.[2]

In the present work the beta-spectra of Ce^{144} and Pr^{144} in equilibrium were studied. The Ce^{144} was obtained from Oak Ridge National Laboratory as carrier-free aged fission product. Part of this material was purified without carrier and a second part purified with carrier cerium added. In both cases the procedure used was precipitation of Ce IV at pH 3.5.