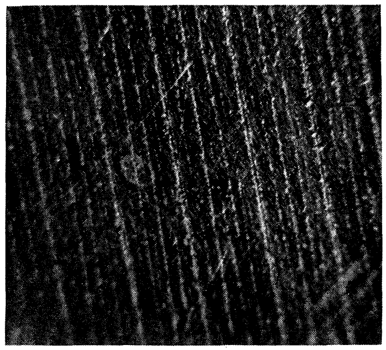

Fig. 5. Pattern obtained on the same grain as that shown in Fig. 4, but at a slightly higher magnetization. Magnification ×16.

In all figures the magnetic field is in this → direction.

In addition, the work of Wolf[2] indicates that iron is a comparatively homogeneous material in which almost all the atoms are in the same state, whereas nickel is made up of two states in the ratio of 3 : 1. In a qualitative way, therefore, if standing waves of some sort, such as Bloch's spin-waves for instance, are associated with magnetization, one would expect them to be more simple in a uniform material like iron than in a material like nickel in which at least three values of J are present.

A more detailed report will appear shortly in this journal.

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[2] A. Wolf, Zeits. f. Physik, **70**, 519 (1931).

The Absolute Values of the Mobilities of Gaseous Ions

The necessity of establishing the absolute values of the mobilities of gaseous ions under conditions of high purity and exact control of experimental conditions has long been recognized. The marked effect of extremely minute traces of impurities on the observed mobilities, as well as the unknown complications introduced in those methods which employ gauzes, air streams of possible turbulence and volumes of ionization vaguely defined make it imperative that a method be employed which is free from all these objections. Prior to the development by Tydall and Grindley (Proc. Roy. Soc. **A110,** 341, 1926) of a mobility method of considerable resolving power, the only method for studying ion mobilities free from experimental uncertainties was that employing ultraviolet light for the production of negative ions. By use of this method Loeb has obtained 2.21 as the absolute value of the mobility of the negative ion in air. The method of Tyndall and Grindley, however, permits ions of both signs to be studied, is free from all the objections mentioned above, and can be adapted to studies where high gaseous purity is maintained. It is, therefore, being employed in these measurements of the absolute mobilities of ions in pure gases.

In the experiments which are at present being carried out, the ionization is produced by intense, hard x-rays from a Coolidge tube under a potential of 80 kv pure D.C. The ionization chamber is of glass, with all metal parts reduced as far as possible in dimensions. The whole may be baked out under vacuum before filling with the gas to be studied which has been passed through a carefully constructed purifying train. A slight adaptation made in the potential cycle applied to the plates of the ionization chamber permits the study of positive ions in gases where free electrons exist.

Under these conditions of purity, the absolute values of the mobility of the positive and negative ions in air have been determined and found to be the same as those obtained by Loeb, Tyndall and Grindley. At normal temperature and pressure, the values obtained are 2.21 cm/sec. per volt/cm for the negative ion and 1.60 cm/sec. per volt/cm for the positive ion, the average age of the ions being 0.05 seconds.

A study of the mobility of the positive ion in hydrogen is of particular interest in view of the results of Loeb (Phys. Rev. **38,** 549, 1931). For Na^+ ions of extremely short age (10^{-5} seconds) he has found an initial mobility of 17.5, which after 10^{-4} seconds, changes abruptly to a value of 13.5. A subsequent change reduces the mobility to 8.4 at which value it becomes independent of the age of the ion. The correctness of these observations, as well as a slight refinement of the absolute values obtained, is most interestingly obtained from experiments made under the conditions described above. A typical curve showing the existence of two distinct classes of ions in hydrogen is shown in Fig. 1. The age of the slower ion is approximately 0.07 seconds. It is the normal ion in hydrogen and has an absolute mobility of 8.25 cm/sec. per volt/cm. The hump on the high mobility side of the curve is definite evidence of the presence of an ion of age equal to 0.04 seconds and mobility 13.1 cm/sec. per volt/cm. While this latter value is not exact owing to the lack of resolving power of the method under such conditions, particularly with the low current intensity obtained in hydrogen ionized by x-rays, the agreement with the value obtained by Loeb is extremely good in view of the uncertain temperature correction in his calculations. These experiments thus obtain a slightly more accurate absolute value for the mobility of the normal ion in hydrogen, and entirely substantiate the existence of one ion of much higher mobility as observed by Loeb. The detection of the 17.5 mobility ion is beyond the limits of this method.

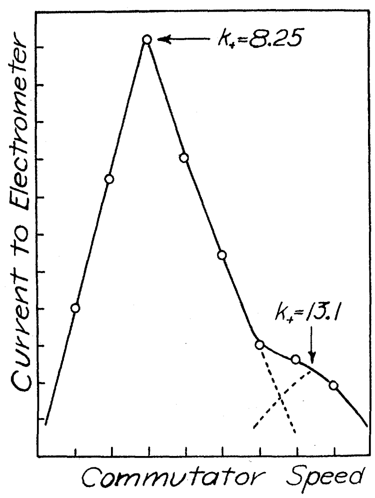

Fig. 1.

The experiments are being continued for ions in other gases.

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The Nuclear Moments of Indium and Gallium

The nuclear moment of indium was reported about a year ago by Jackson (Proc. Roy. Soc. **128,** 508, 1930) to be 1 from a study of the hyperfine structure of the resonance lines. Almost simultaneously McLennan and Allin (Proc. Roy. Soc. **129,** 208, 1930) reported it to be $\frac{1}{2}$ by studying practically the same lines. A more recent communication by Jackson (Nature **127,** 924, 1931) pointed out that the difference between his results and those of McLennan and Allin is just what one would expect from the difference in the resolving powers of their analyzing apparatus. A still more recent paper by McLennan, Allin, and Hall (Proc. Roy. Soc. **133,** 333, 1931) which continues their former investigation, again arrives at the conclusion that the nuclear moment is $\frac{1}{2}$. We have studied the resonance lines of indium using a Fabry-Perot interferometer and find indeed that λ4101 ($5p\ ^2P_{\frac{1}{2}}-6s\ ^2S_{\frac{1}{2}}$) has four distinct components as reported by Jackson, which, while it does not determine the nuclear moment, requires that it be greater than $\frac{1}{2}$. Microphotometer curves of this line show that the outside components are of equal intensity (which would be expected for any value of the nuclear moment) and that the inner components are both of smaller intensity. From the intensity rules this latter would be expected only if the nuclear moment were greater than $1\frac{1}{2}$. The line λ4511 ($5p\ ^2P_{1\frac{1}{2}}-6s\ ^2S_{\frac{1}{2}}$) was reported by Jackson to have four components but as the lines could not be fitted to a level scheme where both initial and final states were split into two, he concluded that he did not have the complete pattern and that one more line existed which he did not resolve. We have found a fifth component which is present very weakly and furthermore a strong indication of broadening in one of the more intense components, showing that the pattern consists of six lines, again in agreement with only those values for the nuclear moment which are greater than 1. The measured intervals are somewhat different from those reported by Jackson and these also point to the higher nuclear moment, the value $2\frac{1}{2}$ giving good agreement with the interval rule. The hyperfine-structure components of this line fall into two groups of three each and it must be that McLennan, Allin and Hall in observing only two lines have not separated the members of the groups. While it does not seem possible to say with certainty at present what the value of the nuclear moment for indium is, it