April, 1958 (unpublished).

[8] All numerical results are obtained from a tabulation of conversion matrix elements which was made for the K shell, point nuclei and no screening. This tabulation will appear in a forthcoming publication, M. E. Rose, Internal Conversion Coefficients, [North-Holland Publishing Company, Amsterdam (to be published)]. Since in the case considered $Q_{L-1} >> Q_L$ the results are almost entirely unaffected by details of the electron dynamics.

ERRATA

The following Letter originally appeared in Phys. Rev. Lett. 1, 52 (1958) (see Editorial, page 90).

POLARIZATION OF FREE POTASSIUM ATOMS BY EXCHANGE COLLISIONS WITH SODIUM ATOMS AND FREE ELECTRONS*

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We wish to report an experiment in which free potassium atoms have been detectably polarized by exchange collisions with free polarized sodium atoms[1] and with free polarized electrons. The apparatus is very similar to that discussed by Dehmelt[2] for his electron polarization experiment in which free electrons were polarized by exchange collisions with an optically pumped (polarized) sodium vapor.

Our sample consists of a 6-cm diameter Pyrex bulb into which has been distilled a mixture of sodium and potassium metal,[3] together with 6 mm argon. There are two 0.03-in. tungsten wire electrodes oppositely located in the bulb, which are employed in creating momentary discharges in the sample. The bulb is normally held at 170°C at which temperature we estimate, from the optical data, that the density of Na atoms is $\sim 5\times10^{10}$/cc and the density of K atoms is $\sim 2\times10^{10}$/cc.

Na resonance radiation from an Osram spectroscopic lamp is sent through a Na-pass optical filter[4] followed by a circular polarizer. This light passes through the sample and is collected by a photocell, the signal from which is amplified and displayed on a CRO. The direction of light propagation coincides with that of a 9-gauss uniform magnetic field developed by 25 in. diameter Helmholtz coils. A 0.04-gauss peak-to-peak sinusoidal field modulation at 15 cycles/sec is supplied by coils coaxial with the main magnetic field. Radio-frequency magnetic fields are developed at the sample by means of 4 turns of wire wrapped around the bulb and excited by a General Radio Unit Oscillator.

The six Na transitions ($F=2$, $\Delta m=1$), ($F=1$, $\Delta m=1$) are well resolved. An example is shown in Fig. 1(b).

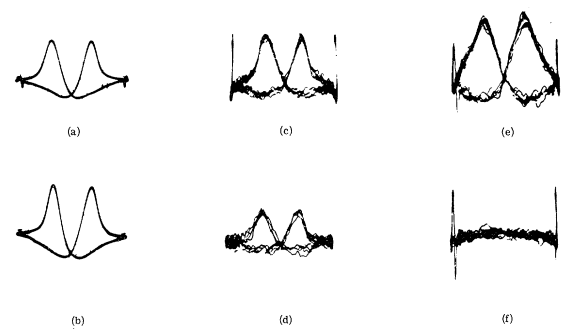

FIG. 1. CRO traces of the sodium, potassium, and free electron resonances. The homogeneous magnetic field is 8.9 gauss, and the modulation field is 0.04 gauss peak-to-peak at 15 cycles/sec. The Na transition ($F=2$; $m=-1 \rightarrow m=-2$) occurs at 6.2 Mc, the K transition ($F=2$; $m=-1 \rightarrow m=-2$) occurs at 6.4 Mc, and the free electron resonance occurs at 25 Mc. The discharge is at 30 cycles/sec and is seen as pips at the extreme ends of the traces.

(a) Na resonance, discharge on. CRO gain = 1 (arbitrary units).
(b) Na resonance, discharge off. Gain = 1.
(c) K resonance, discharge on. Gain = 10.
(d) K resonance, discharge off. Gain = 10.
(e) Free electron resonance, discharge on. Gain = 10.
(f) No radio-frequency, discharge on. Gain = 10.

The corresponding six potassium resonances occur at their proper frequencies with intensities approximately 1/10 that of the Na resonances. An example is shown in Fig. 1 (d). The interpretation is that free K atoms have been polarized by exchange collisions with the optically pumped Na atoms. The rf depolarization of the K atoms is "passed on" to the Na atoms via the exchange process, so that a decrease in the Na light is observed. From a measured alkali relaxation time of $\sim 10^{-2}$ sec and the data given above we compute that the cross section for Na-K exchange collisions is $\sim 5\times10^{-14}$ cm^2. This estimate is considered reliable to within a factor of three.

The calculation of Purcell and Field[5] for H-H exchange collisions was extended to the Na-K process, utilizing the parameters of the Na-K antisymmetric attraction given by Herzberg.[6]

The result is $\sim 7\times10^{-14}$ cm^2 and is considered reliable to within a factor of two.

Free electrons are introduced into the bulb by initiating 2-Mc/sec rf discharges of $\sim$0.002 sec duration, repetitive at 30 cycles per second, and phased so that the discharges occur at the extreme values of the 15-cycle/sec modulation field. (In the CRO displays of Fig. 1 the discharges occur at the extreme right and left hand sides of the trace.) The Na, K, and free electron resonances are shown in Figs. 1 (a), 1 (c), 1 (e). The interpretation of the free electron resonance, following Dehmelt, is that the free electrons remaining after the discharge become polarized by exchange collisions with the opitically pumped Na atoms.

When the discharge is turned on, the sodium resonance decreases by ~20%, while the potassium resonance increases by ~40% (see Fig. 1). We believe the decrease in sodium signal is due to two effects: (1) the discharge tends to "etch out" the sodium vapor, and (2) the free electrons exert a depolarizing effect on the sodium atoms. The potassium resonance increases, however, because the free electrons, polarized by the Na atoms, contribute constructively to the polarization of the potassium atoms via the electron-potassium exchange collisions. The potassium vapor is also etched out by the discharge, but the advantageous electron-potassium exchange effect is generally predominant. The alkali densities and hence the relative changes in the alkali resonances are temperature dependent.

The roles played by the Na and K atoms were reversed by running at higher temperatures (~200°C) and using a potassium arc. The observations are similar to those described above and are in agreement with the computed Na-K exchange cross section.

From the data we estimate that the electron-potassium exchange cross section is $<3\times10^{-14}$ cm^2, in agreement with Dehmelt's estimate for the electron-sodium cross section.[2] We have also obtained this value from unpublished data previously taken with an apparatus almost identical to Dehmelt's, but with potassium vapor only and a potassium arc.

These techniques may be useful in polarizing atomic and ionic species hitherto intractable to direct optical pumping. Experiments along this line are in progress.

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[1] While preparing this manuscript for publication we learned that R. Novick, University of Illinois, has been developing an atom-atom exchange polarization experiment in a sodium-rubidium system; see R. Novick and H. E. Peters, following Letter [Phys. Rev. Lett. 1, 56 (1958)]. We wish to express our gratitude to Professor Novick for several interesting telephone conversations in which ideas common to both of these experiments were discussed.

[2] H. G. Dehmelt, Phys. Rev. 109, 381 (1958).

[3] The Na metal used (Cenco) contains a trace of potassium impurity so that a pre-mixing of the two metals was not necessary.

[4] This filter consists of Corning CS3-69 and CS4-97 plates. It is used to absorb the small amount of potassium resonance radiation emitted by the Osram sodium lamp.

[5] E. M. Purcell and G. B. Field, Astrophys. J. 124, 542 (1956).

[6] G. Herzberg, Spectra of Diatomic Molecules (D. Van Nostrand Company, New York, 1955).

INSTABILITY, TURBULENCE, AND CONDUCTIVITY IN CURRENT-CARRYING PLASMA. O. Buneman [Phys. Rev. Lett. 1, 8 (1958)].

In the fourth line of paragraph 2, the equation $\omega_{pi} = (e\rho/M\epsilon/_0)^{\frac{1}{2}}$ should read $\omega_{pi} = (e\rho/M\epsilon_0)^{\frac{1}{2}}$. In the first display equation, the second term on the left-hand side should read $\omega_{pe}{}^2/(\beta u-\omega)^2$. In the sixth line after the table, the expression $18\,\omega_{pe}$ should read $18/\omega_{pe}$.

DIVERGENCELESS CURRENTS AND K-MESON DECAY. S. Weinberg, R. E. Marshak, S. Okubo, E. C. G. Sudarshan, and W. B. Teutsch [Phys. Rev. Lett. 1, 25 (1958)].

In Eq. (1), "α" should be replaced everywhere by "γ". In Eq. (3), "α" should be replaced everywhere by "∂".

ANGULAR DISTRIBUTIONS OF TRITONS FROM THE $C^{14}(d,t)C^{13}$ REACTION. W. E. Moore, J. N. McGruer and A. I. Hamburger [Phys. Rev. Lett. 1, 29 (1958)].

Line 21 reads: "$\underline{M}$ is the nuclear mass----"; but should read: "$\underline{M}$ is the reduced nucleon mass----".

CONFIGURATION MIXING IN THE C^{14} GROUND STATE. E. Baranger and S. Meshkov [Phys. Rev. Lett. 1, 30 (1958)].

Equation (4) reads "$\delta^2/\alpha^2 = 0.14$"; but should