TABLE I.

K	Transition*	Theoretical freq.** mc/sec.	Actual freq.† mc/sec.
11	−	57,620	57,610
9	−	58,330	58,330
3	+	58,460	58,420
7	−	59,170	59,160
5	+	59,600	59,610
7	+	60,430	60,440
9	+	61,140	61,120
11	+	61,780	61,800
13	+	62,380	62,420
3	−	62,470	62,480
15	+	62,960	62,970
17	+	63,520	63,530
19	+	64,060	64,100
21	+	64,630	64,640
23	+	65,140	65,220
25	+	65,680	65,770

* (+) indicates $J=K+1\rightarrow K$, (−) indicates $J=K-1\rightarrow K$.
** From Schlapp formulas, R. Schlapp, Phys. Rev. **51**, 342 (1937).
† Actual frequency tentatively measured as $f/2$ wave meter accuracy. Estimated error ~15 mc/sec., now being remeasured with a frequency standard.

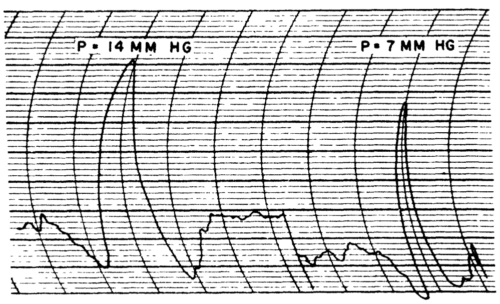

FIG. 1. Recorder tracing of the $J=12\rightarrow 11$, $K=11$ transition of oxygen at pressures of 14 and 7 mm of Hg.

with an electronic frequency standard monitored by station WWV. Figure 1 shows the recorder tracings of one of these lines at different pressures. Over the range of pressures so far studied, the line breadth appears to be proportional to the first power of the pressure. The observed frequencies agree with the theoretical ones within experimental error (about $\pm 15=$ mc) for low K values, but a consistent deviation is observed for high K numbers. Reassignment of theoretical parameters will be made when the precision frequency measurements are completed.

* The research reported in this document has been made possible through support and sponsorship extended by the Geophysical Research Directorate of the Air Force Cambridge Research Laboratories under Contract No. W19-122-ac-35. It is published for technical information only and does not represent recommendations or conclusions of the sponsoring agency.
** The interesting recent work of Beringer in the 3-cm wave region, which included measurements at pressures down to 1.5 cm of Hg was concerned with paramagnetic relaxation in a strong magnetic field (R. Beringer, Phys. Rev. **70**, 53 (1946)).

1 J. H. Van Vleck, Phys. Rev. **71**, 413 (1947).
2 R. Beringer, Phys. Rev. **70**, 53 (1946).
3 Strandberg, Meng, and Ingersoll, Phys. Rev. **75**, 1524 (1949).

Lifetimes of Mercury and Potassium Atoms in Excited States

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October 31, 1949

FOR any $S-P$ transition, the lifetime T is given by the equation

$$T^{-1}=\frac{1}{2JH}\frac{64\pi^4\nu^3}{3hc^3}\Sigma|\psi_i r\psi_f d\tau|^2=3.54\times 10^5\text{ (energy emitted in ev)}^3\times\left[\int_0^\infty S_i r^3 S_f dr\right]^2\text{ sec.}^{-1},\quad (1)$$

TABLE I. Calculated and observed lifetimes for $S-P$ transitions in mercury and potassium.

Atom	Calculated lifetime	Observed lifetime	Observer	Year
Mercury	0.6×10^{-9} sec.	0.3×10^{-9} sec.	Garrett[1]	1932
		1.6×10^{-9} sec.	Ladenburg and Wolfsohn[2]	1930
		1.3×10^{-9} sec.	Wolfsohn[3]	1930
Potassium	2.28×10^{-8} sec.	2.7×10^{-8} sec.	Weiler[4]	1939

where

$$S=Pr^{-\frac{1}{2}}.$$

Using the above formula the lifetimes of the excited mercury and potassium atoms were calculated. The ground state of mercury is $(6S)^2$ and that of potassium $4S$. The radial wave functions of the above ground states have been calculated by Hartree. Using the same self-consistent field method $6P$ and $4P$ wave functions of mercury and potassium atoms were calculated and the lifetime was evaluated by Eq. (1). Observation of Table I will indicate that the agreement between theoretical and experimental values is satisfactory. The high accuracy of potassium is due to polarization of the core being taken into consideration in the calculation of the wave function.

1 P. H. Garrett, Phys. Rev. **40**, 779 (1932).
2 R. Ladenburg and G. Wolfsohn, Phys. Rev. **65**, 207 (1930).
3 G. Wolfsohen, Zeits. f. Physik **63**, 634 (1930).
4 J. Weiler, Ann. d. Physik **1**, 361 (1929).

On the Nature of the π-Meson

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WE want to discuss briefly some aspects of the question of the nature of the π-meson. Following a well-known argument of Oppenheimer and Serber[1] it seems quite proved that the spin of the π-meson is integral, and so we have only two reasonable possibilities for its spin: either it is one or zero. Professor Wentzel[2] has already suggested a method of distinguishing between these two possibilities; furthermore, there are several theoretical reasons which make unlikely the existence of elementary particles having spin one.[3]

We want, therefore, to discuss now the spin zero possibility only. If we were sure that the nuclear forces are due to the π-mesons only, we could conclude that they cannot be scalar. However, we are not sure that this is really the case, and the question, therefore, whether the π-mesons are scalar or pseudoscalar remains open. It has been pointed out, for instance, that the cross section of production of a π-meson by a gamma-ray should increase with the energy just above the threshold more quickly in the case of the scalar meson than in the case of a pseudoscalar meson.[4] There are already some data about the production of mesons by gamma-rays;[5] however, it is not clear whether the energy dependence of the relevant cross section is modified by the fact that in the actual case the production process takes place in a complex nucleus and not in a single nucleon, as it is supposed in the calculations. In order to decide experimentally the question whether the π-meson is scalar or pseudoscalar, it seems therefore surer to devise an experiment in which only a simple process and a very simple nucleus are involved. Such a very simple nucleus could be a nucleus of hydrogen or deuterium only. One of us[6] has already considered the absorption process of a meson in deuterium, pointing out that scalar and pseudoscalar mesons of a very low energy should behave very differently with respect to such a process. In fact, owing to the Pauli exclusion principle, scalar meson waves of even azimuthal quantum number cannot be