Letters to the Editor

PROMPT publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the eighteenth of the preceding month, for the second issue, the third of the month. Because of the late closing dates for the section no proof can be shown to authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

Communications should not in general exceed 600 words in length.

Vibrational Structure of the $^2\Sigma_g^+ \leftarrow {}^1\Sigma_g^+$ Rydberg Series of N_2

Y. TANAKA AND T. TAKAMINE
Department of Physics, University of California, Berkeley, California
March 14, 1941

IN 1938, Worley and Jenkins[1] found a new Rydberg series in N_2 in absorption, namely the (0,0) bands of a series of electronic states converging at $^2\Sigma_g^+$ of N_2^+ (Worley-Jenkins series). Since there are a considerable number of other absorption bands of nitrogen which are not yet analyzed,[2] especially below λ800A, a further study was undertaken in Berkeley with a 3-meter grazing-incidence vacuum spectrograph. The helium continuum was used to produce the background, the pressure of nitrogen in the spectrograph being about 1/100 mm with the path length 130 cm.

One important outcome was the finding of (1,0) bands of the above series, forming another Rydberg series. Naturally, the newly found (1,0) bands appear with much less intensity than the (0,0) bands, but their existence seems to be beyond doubt and constitutes a clear evidence as regards the reality of the Worley-Jenkins series.

In the region between λ938A and λ784A, corresponding to $n=2$ and $n=17$, altogether twelve members were observed, four members $n=5$, 7, 8 and 13 being overlaid by other strong bands. With the data given in the above-cited report by Worley for the Worley-Jenkins series, values of $\Delta G_{\frac{1}{2}}$ (in cm^{-1}) were calculated for different electronic states and found to agree within a few units.

The mean value of $\Delta G_{\frac{1}{2}}$ of eleven members observed comes out as 2171 cm^{-1} and agrees closely with that for N_2^+ $^2\Sigma_g^+$ state, namely 2174.75 cm^{-1}. The limit of the (1,0) bands lies at 127,834 cm^{-1} (λ782.26A) or at 15.77 volts, while the addition of $\Delta G_{\frac{1}{2}}$ for N_2^+ $^2\Sigma_g^+$ to the reported limit of the Worley-Jenkins band gives 127,845 cm^{-1}.

A more detailed report of this experiment, including the confirmation of the N_2 emission bands[3] which converge to the same limit as that of Hopfield's Rydberg series (converging at $^2\Sigma_u^+$), as well as the results for H_2, O_2 and CO absorption bands, will be published in the *Scientific Papers of the Institute of Physical and Chemical Research* (*Tokyo*).

It is a pleasure to thank Professor F. A. Jenkins for his continued interest and advice, and to express our gratitude to Professor R. T. Birge for allowing us to work in Le Conte Hall.

[1] R. E. Worley and F. A. Jenkins, Phys. Rev. **54**, 305 (1938).
[2] In the region between 1000A and 800A, many bands were recently analyzed by Dr. R. E. Worley in Berkeley.
[3] T. Takamine, T. Suga and Y. Tanaka, Sci. Pap. Inst. Phys. Chem. Research (Tokyo) **34**, 854 (1938).

Mean Life of Slow Mesotrons

FRANCO RASETTI
Department of Physics, Laval University, Quebec, Canada
March 15, 1941

THE author recently described[1] an experiment which enabled him to detect the disintegration electrons emitted by mesotrons at the end of their range.

This is a preliminary report of new results obtained with an improved arrangement which was designed to measure a decay curve of mesotrons at rest.

The set-up may be briefly described as follows. A fourfold coincidence counter set defines a beam of mesotrons, which impinges upon a block of iron 10 cm thick and 2.5 cm wide. A battery of anticoincidence counters, placed below the iron, selects the events in which a mesotron is absorbed. It is found that a fraction of these absorption processes is associated with the emission of a particle from the absorber. This particle may be a disintegration electron, or possibly a scattered mesotron.

A system of circuits simultaneously records the numbers n_1, n_2 and n_3 of such particles emitted within, respectively, 36, 3.1 and 1.2 microseconds after the passage of the primary mesotron. It is found that many of the particles are delayed, which is expected to be the case for the disintegration electrons, but not, of course, for scattered mesotrons.

The conditions of the experiment are such that n_1, n_2 and n_3 are affected by a "background" due to undelayed processes (scattered mesotrons+showers) which, however, is identical (not statistically) for all three; hence the differences are significant. Since we can safely assume that all mesotrons have decayed within 36 microseconds, we may write:

$$(n_1-n_2)/(n_1-n_3)=\exp(-1.9\times10^{-6}/\tau).$$

The results for 207 hours of counting are $n_1=170$, $n_2=142$, $n_3=119$. This yields:

$$\tau=3.1\pm1.5 \text{ microseconds.}$$

So far the accuracy of the present measurement is rather poor; its interest lies rather in affording a determination of the mean life that is more direct and less dependent upon accessory hypotheses than the one deduced from the atmospheric absorption effect.

The measurements are being continued in order to increase the statistical accuracy of the result. An investigation of the important point—whether all slow mesotrons or only the positive ones emit a disintegration electron[2]—is also being planned.

[1] F. Rasetti, Phys. Rev., in press.
[2] S. Tomonaga and G. Araki, Phys. Rev. **58**, 90 (1940).