## Angular Distribution of Photoelectrons

In his interesting paper (Phys. Rev. July 15, 1931) J. Frenkel proposes an approximate method, very simple indeed, for computing the angular distribution of photoelectrons emitted by a hydrogen-like atom. The result is identical with that obtained by F. Fischer and with the somewhat more general results presented by F. Sauter (Ann. d. Physik **9**, 217, 1931). The remarks of Frenkel about a discrepancy between his formula and that proposed by myself together with G. Schur (Ann. d. Physik **4**, 409, 1930) are evidently erroneous because my formula turns out to be the straightforward approximation of the formulae of Fischer, Sauter and Frenkel, if one expands the latter according to ascending powers of the velocity ratio $\beta$ and neglects, besides higher powers of $\beta$, a term of a relativistic order of magnitude not substantiated by the present treatments.

A. SOMMERFELD

University of Michigan,
August 17, 1931.

## Note on "The Effect of Piezoelectric Oscillation on the Intensity of X-ray Reflections from Quartz"

In a paper having the above title, published in the Physical Review **37**, 1622 (1931) Messrs. G. W. Fox and P. H. Carr reported an interesting result of their experiment that the intensity of x-ray reflections from quartz is decidedly increased when the crystal is piezoelectrically oscillated.

It should be noted that a similar experiment was in progress in our laboratory in connection with the effects of heterogeneous strain of a crystal upon its reflecting power of x-rays. A crystal such as quartz has a perfect state of crystallization, and especially in the interior of the crystal the extinction effects, primary as well as secondary, are very large, while in the ground surface the crystallization is made somewhat imperfect so that the effects of both extinctions are reduced in a considerable degree. When a Laue photograph is taken through a quartz plate of the thickness of a few millimeters, each Laue spot splits into two (Fig. 1) showing that the reflection of x-rays takes place only in the thin layers near both surfaces, while the interior part of the plate makes little contribution to the reflection. When, however, the plate is oscillating piezoelectrically, a kind of heterogeneous strain is established in it, and the interior part of the plate can no longer be regarded as a perfect crystal. Hence the extinction effects will be reduced and the interior part will be endowed with a strong power of reflection. In Fig. 2 is given the Laue pattern for the same quartz plate as before but in oscillation. Each splitted spot is now bridged over to form a single spot, the intensity being increased enormously.

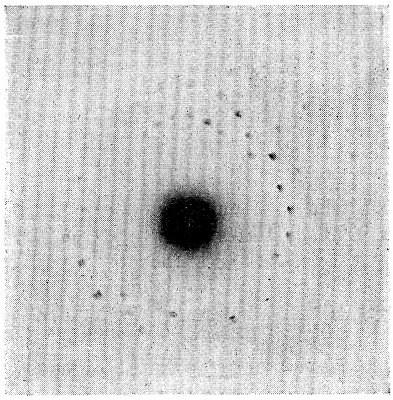

Fig. 1.

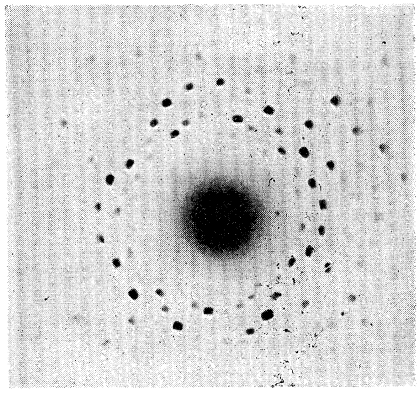

Fig. 2.

A similar effect has been obtained when a

thermal strain was given to the crystal by applying a temperature gradient along a certain direction, of which the experimental result and its interpretation will soon be published. (Proc. of Physico-Math. Soc. of Japan, Ser. III, 13 (1931) 211). Moreover, it was found that, when a mechanical stress is given to the crystal plate so as to produce a heterogeneous strain, a similar effect is also observed. It may be remarked that when the strain is homogeneous as in the case of uniform heating or placing the crystal in a uniform electrostatic field, little effect is produced.

S. NISHIKAWA (Fellow)
Y. SAKISAKA
I. SUMOTO
The Institute of Physical and Chemical Research, Tokyo,
July 26, 1931.

## A New Criterion for Predissociation

Nearly a year ago I reported the striking violation of the Franck-Condon principle caused by some of the rare gases in active nitrogen. (Phys. Rev. **36,** 778, 1930) I named this phenomenon "variation of intensity within a progression" since it involved a variation in the relative intensities of bands which are emitted from the same initial vibrational state. In a later paper I briefly discussed the explanation of this phenomenon in terms of Heitler and London levels and I pointed out that the phenomenon could be understood if one considered forced interactions with repulsive energy levels in the molecule. Transitions will not occur not only to the lower levels which are involved in the emission of the group of bands, but radiationless transitions will take place to repulsive energy levels and the predictions of the Franck-Condon principle will not be applicable. That this is true will be seen when one considers that while the Franck-Condon principle will predict the parts of the initial potential energy curve from which the most probable transitions arise, forced transitions to a Heitler and London curve will rob the different parts of the initial potential energy curve of molecules and thus modify the results of the Franck-Condon principle. If the above explanation is correct then we have here a new criterion for predissociation and also the first case of predissociation which is forced by rare gases since the experiments which I first discussed are those reported by Lord Rayleigh in the Proc. Roy. Soc. **A102,** 453 (1922).

It appears that Turner's evidence for forced predissociation is more direct than the present since in his experiment actual dissociation is observed. In some of my work on nitrogen in which the above phenomenon of variation of intensity in a progression was studied, I obtained very intense nitrogen afterglows for the first time in uncondensed discharges. This was reported (Phys. Rev. **37,** 1004, 1931) before the notion of forced predissociation presented itself. Since then I have discussed predissociation in nitrogen in my report on the auroral spectrum (Phys. Rev. **38,** 582, 1931) before the June meeting of the Physical Society in Pasadena. The present ideas regarding active nitrogen and the production of active nitrogen under such unusual conditions, indicate that the forced predissociation in my experiments resulted in an enhanced production of atomic nitrogen. We have therefore another reason for believing that deviations from the Franck-Condon rule may in many cases be indications of predissociation.

JOSEPH KAPLAN
University of California at Los Angeles,
August 18, 1931.

## Predissociation in Nitrogen and Excitation of the Green Auroral Line

In a recent note in these columns, L. A. Turner reported the enhanced predissociation in iodine, caused by argon. It is the purpose of this note to report some of my experiments in which some evidence has been obtained corroborating Turner's explanation of the above effect.

Frerichs first pointed out that the green auroral line could be intensely excited in narrow capillary discharges in oxygen. I have recently repeated this in oxygen containing varying amounts of nitrogen, in order to study the modifications in the first positive group of nitrogen bands which might be produced simultaneously with the emission of the green line. A preliminary report of the modification of these bands was published in these columns before the aurora line was observed (Phys. Rev. **38,** 373, 1931), and in that note it was pointed out that it was possible to force the emission of certain "heads" which are not observed under usual discharge tube conditions. The rotational analysis of these bands by Naudé was reported in the name number of the journal in which my note appeared, so that it is now possible to define more clearly

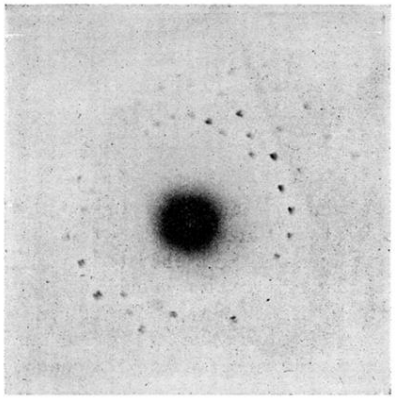

Fig. 1.

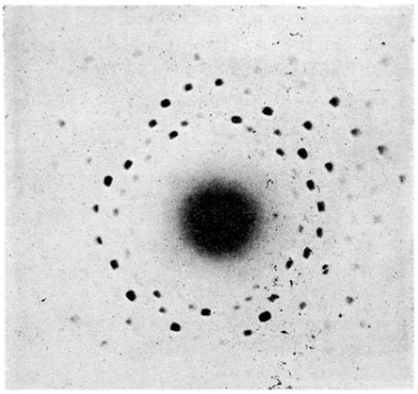

Fig. 2.