Several of the V-K bands are bordered to the red by 2P.G. bands. The writer has judged the maximum of the (1, 11) V-K band to be well away from the position of the (2, 4) 2P.G. band in order to avoid overlapping. For this reason, the temperature quoted may well be a minimum value. In view of this result, it is important that the rotational structures of both the V-K and N_2^+N.G. bands be examined with higher dispersion, and spectrographs now under construction should give adequate spectra. A decision regarding the temperature may then be reached.

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Nuclear Emulsion and Scintillation Crystal Processes

J. B. Birks
Physics Department, Rhodes University, Grahamstown, South Africa
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THERE is a close analogy between the observation of an ionizing particle by a nuclear emulsion and by a scintillation crystal. In each case the particle energy is dissipated in molecular excitation and ionization in condensed matter, but the observed effect is a secondary process, not in general proportional to the specific energy loss dE/dr. For a nuclear emulsion the photographic action can be expressed quantitatively in terms of the specific grain density dG/dr, and for a scintillation crystal the light output can be expressed in terms of the specific fluorescence dS/dr.[1]

Fowler[2] and Bradt and Peters[3] have observed that dG/dr is a nonlinear function of dE/dr. Typical experimental results[3] for an *NTB* 3 emulsion are plotted in Fig. 1. The form of this curve is similar to that observed by the author[1] and Taylor *et al.*[4] for the variation of dS/dr with dE/dr for an anthracene crystal. An exciton theory has been formulated[5] to account for this behavior in scintillation crystals, and the following relation has been obtained:

$$dS/dr = (AdE/dr)/(1+kBdE/dr). \tag{1}$$

This same relation, substituting dG/dr for dS/dr, is found with a suitable choice of the parameters A and kB to describe satisfactorily the behavior of nuclear emulsions. The theoretical curve from (1) is plotted in Fig. 1 and is seen to be in excellent agreement with the observations.

The relation (1) can be expressed in more general terms than those used in its original derivation. The term $A\ dE/dr$ describes the primary production by the ionizing particle of the excitons, photons, or electrons responsible for the observed secondary effect. The term $B\ dE/dr$ describes the simultaneous production of damaged molecules, ions, or other agents, which quench the excitons, photons, or electrons with a capture probability k, relative to the center (fluorescent molecule or silver bromide grain) at which the secondary effect is produced. Previous evidence favors excitons, rather than photons or electrons, as the mode of energy transfer in organic scintillation crystals. Recent work[6,7] on thin films irradiated by α-particles suggests, however, that photons of higher energy than those emitted in the fluorescence and which are strongly absorbed in the crystal may be responsible. If this is so, the mean free path of these photons in anthracene is probably that attributed previously[8] to the exciton, i.e., about 5000 molecular lengths, which is the same order of magnitude as that found in thin nylon films.[6] Conclusions about the energy transfer mechanism in photographic emulsions cannot yet be drawn, though it will probably be similar. The production of quenching agents within the emulsion by the ionizing particle is, however, definitely indicated.

This laboratory is not yet equipped for experimental work on nuclear emulsions, and it is hoped that others will follow up this aspect of the photographic mechanism. In particular, it should be of interest to investigate whether the specific grain density dG/dr decreases to one-half of the value given by (1) at the surface of the emulsion in a similar manner to the decrease of the specific fluorescence dS/dr at the surface of an organic crystal.[8] The mean free path of the exciton, photon, or electron could thus be determined.

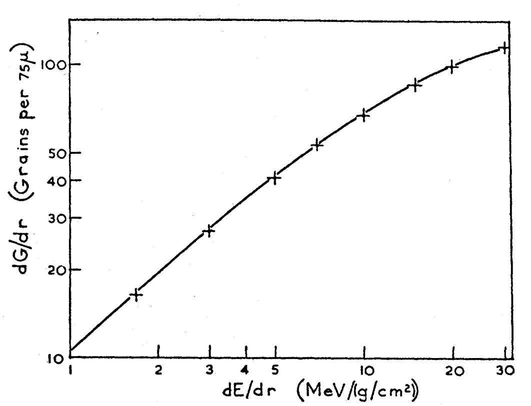

FIG. 1. Specific grain density *versus* specific energy loss. Full curve—theoretical; Crosses—experimental data.

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The Third Forbidden Beta-Spectrum from Rb^{87}

Y. Tomozawa, M. Umezawa, and S. Nakamura
Department of Physics, Faculty of Science, Tokyo University, Tokyo, Japan
(Received December 26, 1951)

RECENTLY, it was pointed out that radiative[1] and mesonic[2] corrections did not affect the consequence of Konopinski's theory of forbidden beta-decay, such as the shape of the spectrum as well as the selection rules. Since this conclusion about the mesonic correction is obtained through consideration of invariance under rotation alone, it can be applied to the case of any

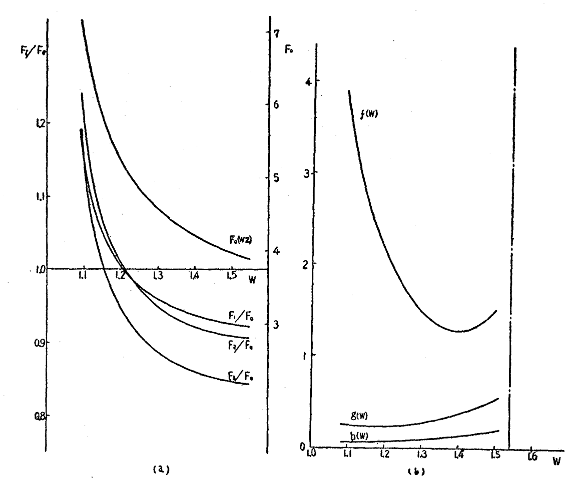

FIG. 1. (a) The functions $F_0(W, Z)$ and F_i/F_0. (b) The functions $f(W)$, $g(W)$, and $h(W)$ in C_{3T}.