Letters to the Editor

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Boundary Effects in the Striated Positive Column

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DURING experiments on the luminosity which has been observed in side tubes connected to tubes in which low pressure spark discharges[1] are being studied, a phenomenon relative to glow discharges was noticed to which the author has seen no reference in the literature. Occasionally, owing to switch leakage, weak glow discharges occurred in the main discharge tube prior to the closing of the switch which set off the spark discharge. This glow discharge exhibited striations in hydrogen gas, which changed position gradually as the current of the discharge increased because of increasing potential of the condenser.

At the junction of the main and side tubes, a remarkable property of the striations was observed. Although stable striations could exist on both sides of this junction, no striation ever existed at A, the dotted position in Fig. 1, where the bounding wall is incomplete on one side. Striations were stable on either side of the opening, clinging to the complete walls of the main tube, and even bowing out into the region of instability. But when the vicissitudes of increasing current compelled striation S_1 to move, it moved abruptly and very quickly to position S_2. In all other positions the striations moved slowly and smoothly along the tube.

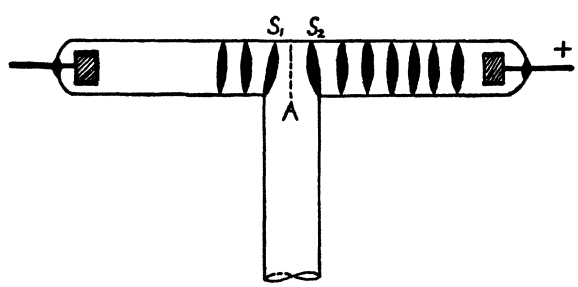

FIG. 1. Branched discharge tube exhibiting a striated glow discharge.

It is suggested that the striations can only exist when completely bounded on their periphery by matter, so that any theory of striations must make use of the concept of boundary conditions.

[1] Fowler, Goldstein, and Clotfelter, Phys. Rev. **82**, 879 (1951).

Beta-Inner Bremsstrahlung Angular Correlation

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DURING an extension of previous measurements[1] of the angular correlation between the 885-kev beta-branch and the 85-kev gamma in Tm^{170}, a strongly interfering effect was observed which has been established as being due to the angular correlation between beta-particles and gamma-radiation emitted during the beta-emission process.

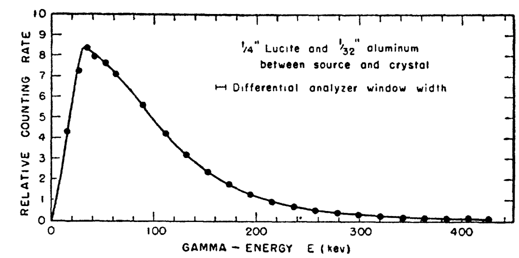

FIG. 1. P^{32} bremsstrahlung NaI(Tl) scintillation spectrometer differential pulse-height analysis.

The theory of this inner bremsstrahlung has been developed by Knipp and Uhlenbeck[2] for allowed spectra and extended to first- and second-forbidden transitions by Wang Chang and Falkoff.[3] The theories predict gamma-emission predominantly in the direction of electron emission. The theoretical angular distribution is not sensitive to the nature of the interaction process in beta-decay.

In order to eliminate true beta-gamma coincidences, the effect was studied in P^{32}, which emits no monoenergetic gamma-radiation. The source was mounted in a thin film in a 7-inch diameter plastic vacuum chamber to avoid air scattering of the beta-particles. The beta-particles were detected by a stilbene crystal, $\frac{1}{4}$ inch thick$\times 1\frac{1}{4}$-inch diameter, mounted on a 5819 photomultiplier tube. The crystal was in the vacuum, an O-ring real to the face of the photomultiplier being used as a vacuum seal. A 0.2-mg/cm² aluminum foil was placed over the stilbene crystal to increase the collection efficiency of the light pulse and to prevent rapid sublimation of the stilbene.

The beta-detector, source, and vacuum chamber rotated as a unit with respect to the gamma-detector, which consisted of a thallium-activated sodium iodide crystal, $\frac{1}{2}$ inch thick$\times 1\frac{1}{4}$-inch diameter, mounted on a 5819 photomultiplier tube. A gamma pulse-height analysis of the continuous gamma-radiation from a P^{32} source is shown in Fig. 1. The cutoff in the neighborhood of 40 kev is due to absorption of the gamma-radiation in the plastic chamber wall, which is sufficiently thick to absorb all of the beta-particles.

The intensity of the gamma-radiation is low (one gamma of energy greater than 40 kev for several hundred beta-particles). It is thus necessary to use a fairly fast coincidence resolving time in order to obtain a true coincidence rate comparable to the chance coincidence rate and still maintain good angular resolution, i.e., a solid geometry factor of 0.5 percent of 0.06 steradian. By double delay line shaping of the relatively slow rising NaI pulse (*ca* 0.25 μsec) a pulse of 0.08-μsec width was obtained. In spite of a loss of a factor of six in pulse height due to the shaping, a considerable advantage in average pulse height was realized compared with anthracene for gamma-energies below 250 kev, mainly owing to

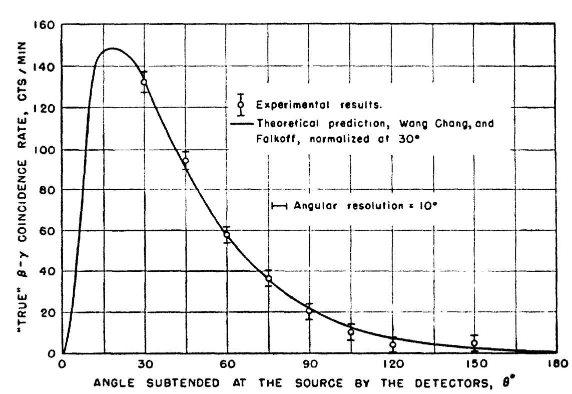

FIG. 2. P^{32} Beta-inner bremsstrahlung angular correlation.