If the ray is travelling perpendicular to the magnetic field H, the deviation $d\theta$ in the distance dx is given by

$$d\theta/dx = 2\pi/2\pi\rho = 1/\rho,$$

where ρ is the radius of curvature. If α is the angle between the original direction of the ray and the plane perpendicular to the magnetic field

$$d\theta/dx = \cos\alpha/\rho. \tag{2}$$

Thus, from (1) and (2)

$$-\frac{1}{\beta c\tau} = \frac{1}{N}\frac{dN}{d\theta}\cdot\frac{d\theta}{dx} = \frac{1}{N}\frac{dN}{d\theta}\left(\frac{\cos\alpha}{\rho}\right),$$

$$\frac{1}{N}\frac{dN}{d\theta} = -\frac{\rho}{\beta c\tau\cos\alpha}. \tag{3}$$

Now

$$mv^2/\rho = Hev/c, \tag{4}$$

and

$$\frac{m}{m_0} = \frac{1}{(1-\beta^2)^{\frac{1}{2}}} = \frac{\tau}{\tau_0}$$

where τ_0 is the rest mean-life. Hence,

$$m_0\tau\beta/\tau_0\rho = He/c^2. \tag{5}$$

If we should take θ as large as 23 degrees and $\cos\alpha = 0.5$, N/N_0 would be 16×10^{-4}. It is therefore obvious that no pencils which have suffered large angles of deviation in the foregoing sense can be expected with any appreciable intensity.

From (3) and (5)

$$\frac{1}{N}\frac{dN}{d\theta} = -\frac{m_0c^2}{\tau_0 Hec\cos\alpha}$$

from which it will be observed that β, and indeed all having to do with the variable energy of the particle, has disappeared from the right-hand side.

Since

$$\frac{m_0c^2}{e} = 10^8/300, \quad \text{and} \quad \tau_0 = 2\times10^{-6},$$

$$\frac{1}{N}\frac{dN}{d\theta} = -\frac{10^6}{3\times2\times10^{-6}\times3\times10^{10}H\cos\alpha} = \frac{-100}{18H\cos\alpha}.$$

If $H=0.7$, we have

$$N = N_0\exp[-8\theta/\cos\alpha].$$

Thus, for example, if $\theta=0.2$ corresponding to about 11.4 degrees

$$N = N_0\exp[-1.6/\cos\alpha],$$

and, if $\alpha = 60°$,

$$N = N_0e^{-3.2} = 0.04N_0 \text{ approx.}$$

[1] It will turn out that the number which survive after the deviation θ will be determined entirely by θ, regardless of any *explicit* statement as to the magnitude of the energy, although, of course, the deviation implicitly determines the energy.

On the Decay of Isotropic Turbulence

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IN a recent letter[1] it was shown how Heisenberg's[2] theory of the decay of isotropic turbulence can be reduced to the discussion of a certain second order nonlinear differential equation for a function $g(y)$ related to the spectrum. The behavior

$$g(y)\sim[6y_0(y-y_0)]^{\frac{1}{3}}$$

of the solution as it cuts the y-axis described in that letter applies only to the right of y_0 and is accordingly not meaningful; to the left of y_0, the behavior is given by

$$g(y)\sim4(y_0-y)+\frac{32}{3y_0}(y_0-y)^{\frac{3}{2}}+\cdots, \quad (y\rightarrow -y_0).$$

This corresponds to $f(x)\rightarrow$constant x^{-7} as $x\rightarrow\infty$ as required by Heisenberg.

I am indebted to Professor Heisenberg for correspondence which clarified the points at issue.

[1] S. Chandrasekhar, Phys. Rev. **75**, 1454 (1949).
[2] W. Heisenberg, Proc. Roy. Soc. **A195**, 402 (1948).

Correlations in Measurements on Superfluidity in Liquid Helium II*

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IN three recent papers[1–3] V. Peshkov has published his latest researches in the field of second sound in liquid helium II. Since this work parallels in some respects portions of the results recently published by the writer[4–6] ** a comparative summary is due at this point. This is particularly the case since these papers[1–3] by Peshkov are not generally available in translated form.*** Peshkov and the writer employ respectively the resonance and pulse methods, so that the mutual results well illustrate the complementary aspects of these two approaches.

A primary objective in each program[3,5,6] was to establish the extreme low temperature behavior of the velocity of second sound. Both programs attained 1°K as a low temperature limit for these measurements. While complete experimental agreement was not forthcoming, the net results showed full substantiation of neither the theory of Tisza[7] nor of Landau[8] at the lowest temperatures. The pulse method[6] revealed the same maximum of about 20.2 m/sec. at 1.65°K observed by Peshkov in his early resonance experiments.[9] Both programs then evidenced a systematic decrease in velocity to minima near the lowest temperature extreme. Actually Peshkov[3] further observed a slight increase at temperatures below his lowest velocity of 18.4 m/sec. at 1.12°K, whereas the writer's data[6] indicate a flat minimum of 19.2 m/sec. down to 1°K (excluding in no way, however, a subsequent rise). These experimental differences cannot be considered as significant in attempting to choose between the two current theories.[7–8]

Investigations of various second-order effects have been made in both programs. Peshkov examined theoretically the effect of second sound extinction on resonance band widths, concentrating his experimental efforts[2] mainly on losses occurring at the solid walls of the resonant cavities used. The writer[4–6] measured attenuation coefficients for video second sound pulses as a function of temperature, and found the attenuation to increase drastically near the λ-point.

Another second-order effect mutually examined was the breakdown of overdriven second sound. This particularly illustrates the complementary approaches of the two methods. The writer observed first sound generation accompanying second sound degeneration by exceeding critical counterflow velocities within the heat pulses.[4–6] Conversely Peshkov detected an anomolous dip in the curve of observed second sound signal *versus* generator input.[2] The order-of-magnitude correlation**** between these results attained by opposite approaches is illustrated by Peshkov's critical heat flow density[2] of roughly 0.4×10^{-2} w/cm² and my value[6] of about 1.0×10^{-2} w/cm² (0.0025 cal./cm² sec.).

In this connection Peshkov discusses[2] the high stability of second sound, persisting as it does under conditions favoring partial degeneration. Similarly second sound pulses were observed under conditions where partial conversion to first sound took place. The latter was observed to be limited,[6] however, to within the first quarter millimeter from the thermal generator, so that the remaining second sound continued without further losses to this process.