assumed that the ζ^0-meson is emitted at this angle θ with an energy γ_0 given by[4]

$$\gamma_0(\theta)=\frac{\bar{\gamma}_0\bar{\gamma}(1+\tan^2\theta)\pm(\bar{\gamma}_0-1)^{\frac{1}{2}}(\bar{\gamma}-1)^{\frac{1}{2}}[1-(\bar{\beta}^2/\bar{\beta}_0^2-1)\bar{\gamma}^2\tan^2\theta]^{\frac{1}{2}}}{1+\bar{\gamma}^2\tan^2\theta}.$$

A monoenergetic spectrum for $\bar{\gamma}_0$ in the center-of-mass system was assumed and the variation of γ_0 with θ was calculated for $20\leqslant\bar{\gamma}\leqslant 50$ with $\bar{\gamma}\geqslant 5$. In this way it was possible with a given θ_s and θ to determined $\gamma_0(\theta)$ and therefore θ_M; Q was taken as 6 Mev. Thus if $\theta_s\leqslant\theta_M$ this pair of mesons could presumably have arisen from the proposed ζ^0 decay scheme.

A total of 21 showers were examined encompassing 278 diffuse shower particles. It was found that the angular separation θ_s for 31 pairs of these particles was such that they could have arisen from ζ^0-meson decay; the criterion $\theta_s\leqslant\theta_M$ was insensitive to the particular choice of parameters given above. On the other hand we expected a certain number of electron-positron pairs arising from the conversion of γ-rays resulting from the two photon decay of the neutral meson. Using the value[3] of 0.41 for the ratio of neutral mesons to charged particles and taking into account a finite lifetime for the π^0-meson,[5] we find that at least 26 electron-positron pairs are expected to appear in the observation area: we find then on the assumption that all the charged shower particles observed are π-mesons that 4 ± 4 percent[6] of these mesons can arise via the scheme $\zeta^0\rightarrow\pi^++\pi^-+Q(<6$ Mev). We believe, however, that our data do not require the introduction of this new particle to explain the observed angular correlations.

A possible explanation of the observations of Danysz, Locke, and Yekutieli has been suggested by Brueckner and Watson.[7] They suggested that the observed angular correlations of Danysz *et al.* are due to distortions introduced in the outgoing meson wave function by an attractive meson-meson potential: this might be expected to have a relatively strong influence for the relatively low energy mesons observed in low multiplicity showers, whereas it would be expected to be a very small effect in the very high energy showers reported on in this note.

[1] Danysz, Lock, and Yekutieli, Nature 169, 364 (1952).
[2] M. F. Kaplon and D. M. Ritson, Phys. Rev. 85, 932 (1952).
[3] M. F. Kaplon and D. M. Ritson, Phys. Rev. to be published.
[4] Bradt, Kaplon, and Peters, Helv. Phys. Acta 23, 24 (1950).
[5] Kaplon, Peters, and Ritson, Phys. Rev. 85, 900 (1952).
[6] B. Peters (private communication) has made an analysis similar to ours in the diffuse cone of energetic showers and finds no evidence for the existence of the ζ^0-meson. Danysz and co-workers find on the assumption of the existence of the ζ^0-meson that 10 percent of the charged π-mesons arise from its decay; J. Y. Mei and E. Pickup, Phys. Rev. 86, 796 (1952) report a similar figure if the ζ^0 is assumed to exist.
[7] K. A. Brueckner and K. M. Watson, Phys. Rev. 87, 621 (1952).

Some Effects of Ionizing Radiation on the Formation of Bubbles in Liquids*

DONALD A. GLASER
University of Michigan, Ann Arbor, Michigan
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FOR many problems connected with the study of high energy nuclear events and their products in cosmic-ray interactions, it would be very desirable to have available a cloud-chamber-like detector whose sensitive volume is filled with a hydrogen-rich medium whose density is of the order of 1 g/cc. In investigating possible ways of making such an instrument, it seemed promising to try to make a device which takes advantage of the instability of superheated liquids against bubble formation in the same way that a Wilson cloud chamber utilizes the instability of super-cooled vapors against droplet formation.

A macroscopic continuum theory of the stability of small bubbles in a superheated liquid has been developed which predicts that bubbles carrying a single electronic charge will tend to collapse more readily than uncharged bubbles, while bubbles carrying two or more charges will be unstable against rapid growth under some circumstances. On the basis of this picture one can estimate the conditions of temperature and pressure under which a pure liquid in a clean vessel becomes unstable against boiling due to the presence of ions.

An experimental test of the theory for radiation-induced ionization was made by maintaining diethyl ether in a thick-walled glass tube at a temperature near 130°C and under a pressure of about 20 atmospheres. In the presence of a 12.6-Mc Co^{60} source, the liquid in the tube always erupted as soon as the pressure was released, while when the source was removed, time delays between the time of pressure release and eruptive boiling ranged from 0 to 400 seconds with an average time of about 68 seconds. The average time between successive traversals of the tube by a hard cosmic-ray particle is estimated to be 34 seconds.

A second test was made by removing the Co^{60} source from its lead shield at a distance of 30 feet from the ether tube while the latter was sensitive and waiting for a cosmic-ray or local ionizing event. In every case the tube erupted in less than a second after exposure to the source.

A "coincidence telescope" consisting of two parallel tubes was constructed and coincidences apparently resulting from vertical cosmic rays were observed with roughly the expected ratio of single to coincident eruptions. The coincident bubbles occurred near each other in the two neighboring tubes, but other single events occurred at random at different places in the tubes.

According to the proposed explanation of the radiation sensitivity of bubble formation, one expects the threshold conditions of temperature and pressure of the system to be different for the formation of bubbles carrying 2, 3, 4, or more elementary charges. The shapes of the observed delay time curves for different pressures and temperatures are consistent with this expectation.

On the basis of the suggested model for the observed phenomena, it is possible to estimate with the aid of a statistical hole theory of liquids the influence of ionizing radiation and ionic impurities on phenomena such as turbulent and supersonic cavitation, tensile strength and compressibility of liquids, scattering of supersonics in liquids near their boiling points, "bumping" of boiling liquids, maximum attainable superheats in liquids, etc. Further details concerning the experimental and theoretical aspects of the problem will be published elsewhere.

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Effect of Radiation on Elastic Constants

F. R. N. NABARRO
Department of Metallurgy, The University, Birmingham 15, England
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DIENES[1] has recently published a calculation of the effect of interstitial ions and vacant lattice sites on the elastic constants of copper and sodium. He finds that 1 percent of vacant lattice sites decreases all the elastic constants by about 1 percent, while 1 percent of interstitial ions increases some of the lattice constants of copper by 10 percent. He uses an approximation in which the distorted lattice deforms homogeneously under a homogeneous applied stress; the large increase of energy around interstitial ions which are already abnormally close to their neighbors gives rise to large increases in the elastic constants. The purpose of the present note is to show that this approximation overestimates the difference between the effects of interstitial ions and of vacant lattice sites, because a homogeneous applied stress will produce less distortion near an interstitial ion than it does in the matrix, and, similarly, more distortion near a vacant site. This may most readily be seen by considering the limiting case in which the interstitial ion is rigidly wedged between its neighbors. On Dienes's approximation this rigid wedging would make an infinite contri-