ing in the Coulomb field. This effect might be detected in investigating small angle scattering of photons.

It would be expedient to examine separately the case of small energies, *i.e.*, the region in which the cross section differs little from the cross section given by Thomson's formula. In this case we can write

$$\alpha = \Delta_1, \ \beta = \Delta_2, \ \gamma = \Delta_3 + a, \ \delta = \Delta_4 + a. \quad (7)$$

If $\Delta_i = 0$, Eq. (4) with $a^2 = (16/9)k_\gamma^2(e^2Mc^2)$ goes over into Thomson's formula

$$d\sigma/d\Omega = {}^1/_2(e^2/Mc^2)^2(1+\cos^2\theta). \quad (8)$$

If we express X, Y, Z and W in (4) in terms of Δ_i and a and neglect the terms $\Delta_i\Delta_k$, we obtain

$$d\sigma/d\Omega = (1/32\,k_\gamma^2)[(9a^2 + 6\bar{X}a)(1+\cos^2\theta) + 12\,a\bar{Y}\cos\theta]. \quad (9)$$

Here $\bar{X} = \Delta_3 + 2\Delta_4, \ \bar{Y} = \Delta_1 + 2\Delta_2.$ (9a)

Comparison of Eq. (9) with experiment should make it possible to check the assumptions made in deriving it and enable us to determine $\bar{X}$ and $\bar{Y}$, which is important inasmuch as $\bar{X}$ is expressed only through quantities connected with electric radiation, while $\bar{Y}$ is expressed only through quantities connected with magnetic radiation.

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Use of a Mixture of Two Liquids in Bubble Chambers

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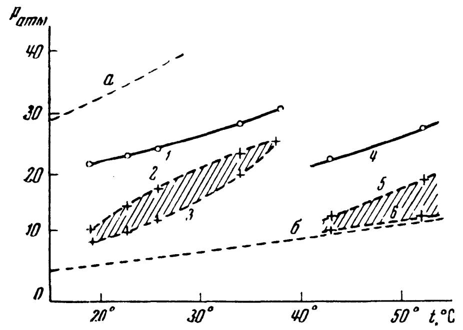
As THE SIZE of bubble chambers is increased, the technical difficulties involved in their operation become ever greater in view of the necessity of producing and maintaining the temperatures and pressures approprite to the liquid employed. These difficulties could be largely obviated if it were possible to work at close to room temperature. Of the substances employed in bubble chambers hitherto, the two having a working temperature closest to room temperature are propane ($t_{work} \approx 64°$ C) and Freon-13 ($t_{work} \approx 0°$ C). We assumed that a convenient working temperature could be obtained by using appropriate mixtures of two liquids.

For the purpose of exploring the possibility of employing mixtures we carried out a series of experiments with a bubble chambe filled with a mixture of Freon-12 (CCl_2F_2) and Freon-13 ($CClF_3$). For Freon-12 the critical temperature and pressure are 111.5° C and 39.6 atmospheres; for Freon-13 the respective values are 28.8° C and 39.4 atmospheres. The chamber described in an earlier communication[1] was used for the tests. Inasmuch as this chamber has a pressure-actuated device for limiting the expansion, the sensitivity of the chamber was controlled by varying the lower level of the pressure drop at constant temperature. With a Co^{60} γ-source mounted in front of the chamber window it was possible to observe and photograph the electron tracks and establish at what temperature, pressures and concentrations observation of the tracks was feasible.

We used two different mixtures, containing about 40 and 75 percent molar Freon-12. In the first case the pressure of the saturated vapor of the mixture was 21 atmospheres at 19° C; in the second case 21.6 atmospheres at 43° C. The temperatures and pressures at which particle tracks could be observed in each case are shown in Fig. 1. The tests were carried out at temperatures ranging from 19 to 38° C for the first mixture and from 43 to 52° C for the second. Curves 1 and 5 in the figure are drawn through the points corresponding to the sensitivity threshold. With pressure drops to a lower level there was observed an increase in sensitivity (shaded areas in figure). Curves 3 and 6 denote the lower boundary of the pressure drops. At these pressures fog was



Dash lines—pressures of the unsaturated vapors of pure: (a) Freon-13, (b) Freon-12. Solid curves—same for the mixtures: (1) 40% Freon-12, (4) 75% Freon-12. Curves 2 and 3 bound the working region for the first mixture; curves 5 and 6 bound the region for the second mixture.

observed in the chamber at temperatures of 34 and 38° C for the first mixture and 52° C for the second mixture; at other temperatures there was no fog formation since it was impossible to realize a greater pressure drop due to boiling of the mixture in the separator.

The chamber was expanded every 10 sec. In all experiments the pressure in the chamber between expansions was 35 atmospheres. The sensitivity time was determined from photographs exposed with different delays relative to the beginning of pressure relief. The sensitivity time was found to be 40 microseconds.

Thus satisfactory operation of a bubble chamber is possible with a mixture which at room temperature has a saturated vapor pressure of about 21 atmospheres. The suggested mixture by virtue of its high density (~ 1.0 g/cm³) is convenient for many nuclear investigations. The use of mixtures makes it easier to select the best "working substance" for a given physical problem. Of particular interest would be hydrogen-containing mixtures, for example, a mixture of methane with propane, which has been used in a "gas" bubble chamber,[2] or a mixture of ethane and propane.

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Two-Electron Green Function in the Bloch–Nordsieck Approximation

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THE ELECTRON GREEN FUNCTION in the Bloch–Nordsieck approximation[2] has been considered in an earlier work.[1] As is well known, the Bloch–Nordsieck approximation, in which the matrix γ^μ is replaced by the c-number u^μ, allows a consideration of the interaction of an electron with long-wave photons. In the present work we consider the two-electron Green function in this same approximation.

In the Bloch–Nordsieck approximation the Schwinger equation[3] has the following form:

$$\left\{iu^\mu \frac{\mu\partial}{\partial x^\mu} - m + \sqrt{4\pi}\, eu^\mu A_\mu(x) + i\sqrt{4\pi}\, eu^\mu \int D_{\mu\nu}(x, \xi)\frac{\delta}{\delta A_\nu(\xi)}\, d\xi\right\} G(x, x'; y, y' \mid A)$$
$$= \delta(x-y')\, G(x', y \mid A) - \delta(x-y)\, G(x', y' \mid A), \tag{1}$$
$$u^2 = (u^0)^2 - \mathbf{u}^2 = 1, \qquad m \to m - i\varepsilon\ (\varepsilon > 0,\ \varepsilon \to 0).$$

In this case the one-electron Green function satisfies the equation

$$F_x G(x, y \mid A) = -\delta(x-y), \tag{2}$$

where F_x is the operator which appears in the curly brackets in the left-hand part of Eq. (1).

The solution of Eq. (1) is given by