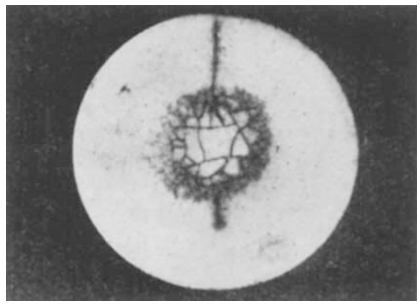

Fig. 4. Electrical porcelain after 1,000 shocks at 150 cal./cm.²sec. Note major cleavage crack in path of jet across surface

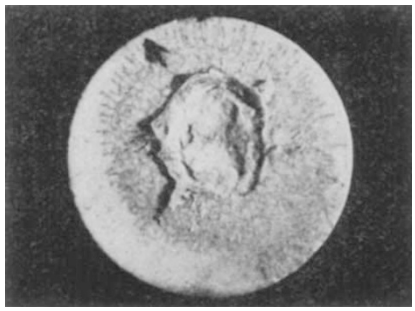

Fig. 5. Electrical porcelain after 10 shocks at 400 cal./cm.²sec.

soda glass and that did so normal to the path of the jet.

This work forms the initial stage of a fundamental study of the thermal shock behaviour of ceramic materials. I wish to thank Mr. Dugdale of the Metallurgy Division, United Kingdom Atomic Energy Authority, Harwell, for his advice and help during the earlier part of this investigation.

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The Parametric Line : a Photon and Gravitational Field Analogue

Let E and v be the energy and velocity of a pulse in a 'parametric line'[1], denoting the input and output ends by the subscripts 1 and 2 respectively. It has been shown[1] that the pulse energy amplification factor has the form :

$$E_2/E_1 = v_2/v_1 \qquad (1)$$

If this factor does not differ very much from unity, it can be written in the form :

$$E_2/E_1 = [\{(L/T)(v_2 - v_1)\}/\{\tfrac{1}{2}(v_1 + v_2)\}^2] + 1 \qquad (2)$$

where L is the length of the line, T is the time necessary for traversing the line and $\frac{1}{2}(v_1 + v_2)$ is the average speed of the pulse along it.

According to the General Theory of Relativity, an electromagnetic wave packet running over a length l in the direction of a gravitational field of intensity g (units of acceleration) gains frequency and hence energy[2]. The initial and final energies (ε_1 and ε_2) are related according to :

$$\varepsilon_2/\varepsilon_1 = 1 + \{gl/c^2\} \qquad (3)$$

where c is the velocity of light.

An analogy between equations (2) and (3) is established by substituting c for $\frac{1}{2}(v_1 + v_2)$, g for $(v_2 - v_1)/T$, l for L and ε for E. It will be noted that in each case the substitutions have the same dimensions.

Another analogy can be derived by considering the frequency spectrum of the pulse. Denoting the spread of the frequency by f and the duration of the pulse by τ, it follows from Fourier's theorem that :

$$\tau_1 f_1 = \tau_2 f_2 \simeq 1 \qquad (4)$$

It has been shown that in a parametric line (ref. 1) :

$$\tau_1/\tau_2 = v_1/v_2 \qquad (5)$$

It follows from (4), (5) and (1) that :

$$E_1/f_1 = E_2/f_2$$

This equation resembles the energy frequency (ε, ν) relation

$$\varepsilon/\nu = h$$

where h is Planck's constant.

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[1] Physical Society Exhibition (demonstration 1960), further details to be published (*Phys. Soc. Handbook 1960*, p. 104).

[2] Wilson, H. A., *Modern Physics*, **6**, 332 (Blackie and Sons). Equation (3) may be derived by considering a small distance dr in which the field is considered uniform and by substituting ordinary units for the special units used. dt'/dt is taken to be equal to $v_2/v_1 = \varepsilon_2/\varepsilon_1$. See also *Electronic Technology*, **39**, No. 7, 267.

Standard Unit of Pressure in Vacuum Physics

It is regrettable that spokesmen for the Bureau International des Poids et Mesures[1] and the Standards Division of the National Physical Laboratory[2] have failed to understand my recent communication[3].

Previous work on standardization has unfortunately resulted in the use of two units in the vacuum field, not related decimally to each other : millibar and torr, the latter being not equal to mm. of mercury[4]. My endeavour was to propose a practical solution to this problem much discussed by vacuum physicists and technologists in recent years. An attempt, therefore, was made to define a new unit which, being decimally related to both mm. mercury and c.g.s. (and m.k.s.) unit of pressure, could be considered as the standard unit of pressure in vacuum physics. The unit proposed, which was conveniently termed 'vac', should not be confused with millibar, as was done by the commentators mentioned above, the millibar invariably being nothing else than a multiple of the absolute unit of pressure, while the vac is defined in terms of the height of the mercury column under specified conditions. The new unit does not bring great implications in practical use. It represents an acceptable compromise to satisfy the international systems of units, and to avoid the replacement of mm. mercury by an arbitrary unit, like the torr.

I may mention that a detailed discussion of this matter has been reported elsewhere[5].

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[1] Volet, Ch., *Nature*, **188**, 1017 (1960).
[2] Bigg, P. H., *Nature*, **188**, 1017 (1960).
[3] Florescu, N. A., *Nature*, **188**, 303 (1960).
[4] British Standards Inst., B.S. 2951 (1958).
[5] Florescu, N. A., Rep. VP–1 (School of App. Phys., Univ. N.S.W., 1960).