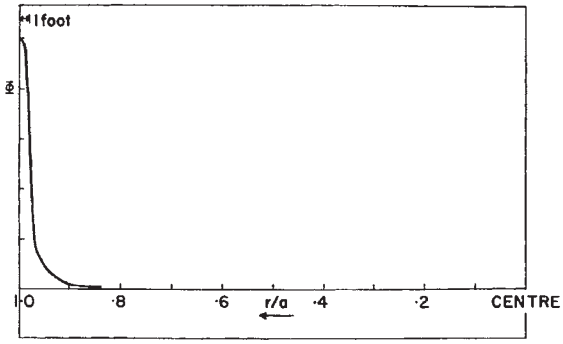

Fig. 1

Assuming $n = 100$, I carried out the numerical computation of the function Φ, in which A was given a value such that the function becomes unity at the surface $R = a$.

The property of the curve given in Fig. 1 agrees well with my auditory observation in St. Paul's Cathedral. If the ear is moved about 10 in. from the wall the intensity of the sound does not change much; but after that it falls off rapidly. Since the circular corridor along the wall is about 6 ft. wide, the observation cannot be continued further than that; but in fact the whisper is scarcely audible at the edge of the corridor.

These characteristics are exactly those of the so-called guided waves. In a homogeneous medium of half-space, sound waves do not give surface waves like Rayleigh waves in a solid. However, if the medium is surrounded by a rigid spherical wall, a kind of guided wave can exist, and this is what is observed in whispering galleries. The surrounding wall is neither exactly spherical nor circular cylindrical in the case of St. Paul's Cathedral; but these calculations give a rough approximation of what takes place in the gallery.

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Measurement of Pressure in Vacuum Physics

THE torr has recently been adopted as the British standard unit for the measurement of pressure in vacuum physics; but the fact that proposals have been made for further change[1,2] indicates that the present system is not yet satisfactory. The recent proposals have been concerned with definition of units; but the practical expression of pressures in terms of these units appears also to be due for revision.

The range of pressures encountered in vacuum physics is at present about 10^3–10^{-11} torr, so that to cover this range with a single unit the conventional method is to use the exponent; the alternative method of expression of pressures as small decimal fractions of a torr is obsolescent, and its main continued use appears to be in the usual calibration of the scale of the McLeod gauge. Thus we are at present expressing pressures less than atmospheric with a range of exponents which may be positive or negative, with the zero exponent corresponding to no clearly recognizable pressure. As improvements in high-vacuum techniques continually decrease the pressures attainable in vacuum systems the problem of expression becomes aggravated as we are forced to use larger negative exponents; this makes more obvious the terminological inconsistency of a 'higher' vacuum corresponding to a smaller number.

A similar problem, the expression of hydrogen-ion concentration in aqueous solution, was elegantly solved by the introduction of the pH scale, which has been universally adopted and has proved satisfactory over many years of use. In most vacuum measurements the problem is quite analogous; we are concerned mainly with the order of magnitude of the pressure.

It is proposed therefore that the new unit the vac[2], which has excellent theoretical justification, would be an ideal basis for a p Vac scale. If zero on the scale is taken as 10^3 vac, which is almost one standard atmosphere, it is possible to define a scale analogous to the pH scale:

$$p\,\mathrm{Vac} = -\log \mathrm{vac} + 3$$

Thus, zero is atmospheric pressure, all practical vacua will be positive, and the larger p Vac, the higher the vacuum.

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The Special Theory of Electromagnetism

THE law of addition of collinear velocities as derived from the Lorentz transformation in special relativity is:

$$W = \frac{U + V}{1 + UV/c^2} \qquad (1)$$

U and V being the components, W the resultant velocity and c the velocity of light. It follows that W can never be greater than c.

Despite this failure in kinematics of the classical law of vector addition, that law is still used in other fields of physics. This communication shows what modifications to electrostatic theory are necessary if a rule analogous to equation (1) is adopted in its place.

Introducing 'electric interval' $d\sigma$ by the relation:

$$d\sigma^2 = dr^2 - \varkappa^{-2} d\varphi^2 \qquad (2)$$

where dr and $d\varphi$ have their usual meaning for an observer and $\varkappa$ is a universal constant, the addition of collinear electric vectors now follows the rule:

$$E = \frac{E_1 + E_2}{1 + E_1 E_2/\varkappa^2} \qquad (3)$$

and $\varkappa$ is recognized as the limiting attainable resultant, presumably corresponding to a break-down field-strength.