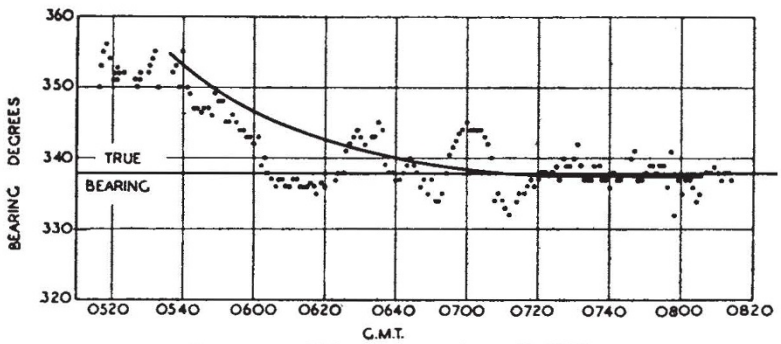
Lateral Deviation of Radio Waves at Sunrise

THE observation of systematic lateral deviations of radio waves requires that such deviations shall be large enough not to be obscured by the random deviations always occurring. The sunrise period is particularly favourable for such observations, since the relatively rapid changes in ionization at this time produce appreciable horizontal ionization gradients. The direction of these is such as to move the reflexion point of the ray towards the east, and qualitative confirmation of this effect has previously been noted.

Some further observations have been made at the Radio Research Station, Slough, on the British Broadcasting Corporation 6·05 Mc./s. transmitter *GSA* in Cumberland, a distance of about 400 km. from Slough. The experiments were carried out during April and May 1946, the sunrise line being then approximately along the transmission path. The instrument used was a rotating spaced-loop direction finder[1], and the period of observation was two to three hours around sunrise, covering the normal time at which the maximum usable frequency condition was attained.



BEARING OF *GSA* AT SLOUGH, APRIL 12, 1946
•·····, observed bearing; ———, calculated bearing

The bearings immediately following the maximum usable frequency condition were usually some ten or twenty degrees to the east of the true direction, which was afterwards gradually approached. This process occupied a time varying on different days from a few minutes up to nearly an hour. Thereafter the bearings showed fluctuations of a few degrees about the true value but no systematic deviations.

A quantitative estimate may be made of bearing deviations to be expected from the changes with time of equivalent height of reflexion, obtained from vertical incidence ionospheric data. Calculations on this basis agree with the directional observations in giving the largest deviations when the frequency is close to the maximum usable frequency, since the equivalent height is then falling most rapidly with advancing time.

Detailed quantitative correlation is not in general possible owing to complications involved by the presence of the extraordinary ray. On one occasion, however, when the observed bearing changes took place comparatively slowly, a simple calculation of equivalent height based on the ordinary-ray transmission alone was found to give good agreement with the experimental results. The observed and computed bearings are shown in the accompanying graph.

The ionospheric data used were obtained from vertical incidence measurements made at the Radio Research Station, Slough, and this note is published by permission of the Department of Scientific and Industrial Research.

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[1] Ross, W., *J. Inst. Elect. Eng.*, in the press.

Fluid Flow at a Small Hole due to Vibration

PROF. GILBERT WEST has recently described[1] an ingenious experiment in which a stream of smoke-laden air is made to issue from a hole in a cylindrical resonator when an appropriate tuning fork is brought near. This is said to demonstrate the pressure of sound, but I am much in doubt as to whether it does so.

The passage of a sound wave cannot cause any bulk streaming of the air, so that the suggestion is, I take it, that the sound wave exerts a pressure on each smoke particle, as it undoubtedly does on an extended surface. I have pointed out, however, that an ordinary smoke particle takes up practically the full vibratory amplitude of the air at ordinary frequencies; for example, at 600 c./sec. smoke particles of diameter 1 μ acquire 0·9999 of the full amplitude of the sound vibration[2]. In these circumstances no pressure is exerted on them.

Prof. West's experiment is, in my opinion, a demonstration of an interesting effect known to me for many years and first described, I believe, by H. Sell[3]. A cylindrical box is closed on one side by a flat surface carrying a small metal jet: opposite this is a diaphragm which can be set in vibration. When the diaphragm is excited there issues from the jet a stream of air which can blow a light vane aside. The explanation is quite simple. When the diaphragm moves so as to expel the air, the air issues in a well-defined stream; when it moves back so as to suck in the air, the air enters from all sides. The air expelled is equal in volume to that sucked in, but the path of the entering air differs from that of the expelled air, just as the lines of flow of a liquid at the entry of a capillary tube differ from the lines of flow at exit.

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[1] *Nature*, **158**, 755 (1946).
[2] *Proc. Roy. Soc.*, A, **134**, 445 (1931).
[3] *Z. tech. Phys.*, **5**, 573 (1924).

Measurement of Visual Acuity with Blurred Tests

WHEN testing visual acuity with Snellen's current type, we use black letters printed upon a white ground, and the transition from black to white is as abrupt as can be. If the patient's eyes are emmetropic, or hyperopic without presbyopia, or myopic and corrected, the retinal image of the test remains sharp,