ject to heavy radio-frequency heating the average temperature of the liquid could not be determined quite accurately. Considering the uncertainty in the measurement of this temperature, the results may be taken to indicate that there is no dispersion of ultrasonic velocity in water up to 300 Mc./s. The values for the velocity are in fairly good agreement with those reported by other investigators. The wave-length of sound in water corresponding to 297·03 Mc./s. employed in this investigation is 0·000503 cm., which is only about twelve times the wave-length of mercury green light in water.

The general features of the diffraction pattern at 300 Mc./s. are similar to those at 180 Mc./s. reported earlier. The sharpness of the appearance of the diffraction line around the Bragg angle of incidence is, however, more prominent at the higher frequency. Quantitative study of the variation of intensity of the diffraction pattern with angle of incidence and width of the sound field is in progress and the results will be reported in due course.

B. Ramachandra Rao
J. Satyanarayana Murty

Physics Department,
Andhra University,
Waltair.
Feb. 24.

[1] *Nature*, **161**, 927 (1948); *Proc. Ind. Acad. Sci.*, **28**, 54 (1948).

Calibration of Vibration Pick-ups at High Frequencies using a Michelson Interferometer

Most existing methods of calibrating vibration pick-ups employ some form of extrapolation, that is, the pick-up is calibrated at low frequencies, where the amplitude can be made large, and the result is then extended to higher frequencies. Since it is considered that this method is unsatisfactory, a Michelson interferometer capable of measuring vibratory amplitudes down to 4×10^{-6} in. has been constructed. The upper limit of the calibration frequency is largely determined by the type of vibration pick-up and by the driving vibrator, but the present arrangement can be used up to 10 kc./s.

The Michelson interferometer takes its usual form except that it is mounted in a vertical plane for convenience. One of the two mutually perpendicular mirrors is attached to a block on the vibrator armature and the vibration pick-up is fixed to the same block. Using monochromatic light (in this case the green line of mercury at 5461 A.), circular fringes are set up in the usual manner. As the vibration amplitude is slowly increased, the fringes alternately disappear and reappear. The disappearance, that is, when the field of view is apparently uniformly illuminated, is quite sharp and each disappearance corresponds to a definite amplitude of vibration of the moving mirror, and Ostberg (1932) has calculated these amplitudes. Provided the vibration wave-form is a pure sinusoid, these amplitudes are determined by a Bessel function of order zero and the first three values are approximately 4·1, 9·4 and 14·8 millionths of an inch for a light wave-length of 5461 A.

Preliminary experiments have shown that this apparatus can be used for calibrating a barium titanate accelerometer over a frequency-range of 500 c./s. to 10 kc./s. It can also be used for proving that the output of the accelerometer at a given frequency is proportional to the amplitude of vibration, that is, to the acceleration.

S. M. Davies

E.M.I. Engineering Development, Ltd.,
Victoria Road,
Feltham,
Middlesex.
March 29.

Inadequacy of Recombination as the Source of Light from Enduring Meteor Trains

It has been suggested[1,2] that the enduring column of light left by a meteor in its passage across the sky is produced by radiative recombination of the meteoric ions and free electrons. We wish to criticize this hypothesis on a quantitative basis.

Consider a line of q ion pairs per cm. which diffuse with an ambipolar diffusion coefficient D cm.^{2}/sec. to form a column with a Gaussian cross-section.

Let α_e be the recombination coefficient of the ions and electrons and p be the luminous energy emitted per recombination event between wave-lengths 4680 A. and 5560 A. The luminous energy, I, emitted per cm. of train per second is then given by the equation

$$I = \frac{p\,\alpha_e\,q^2}{8\pi D t} \qquad (1)$$

where t is the time that has elapsed since the passage of the meteor.

Let us consider a Perseid and a Geminid meteor with absolute visual magnitudes $-2 \cdot 0$ and $-3 \cdot 0$ respectively. The work of various authors enables us to compute the brightness of the train from equation (1).

(i) Öpik[2] has computed the visual intensities from the cascade spectra for recombination of the ions that are to be expected in meteor columns; he finds that the most efficient reaction is Fe II $(a^4p) + e \rightarrow$ Fe I, where $p = 1 \cdot 51 \times 10^{-12}$ ergs. Öpik computed the recombination coefficient for this reaction and for recombination events involving other atoms. After correction to a temperature of 212° K., we may adopt $\alpha_e = 2 \cdot 6 \times 10^{-12}$ cm.^{3} sec.$^{-1}$.

(ii) From the duration of radio echoes observed by Millman[1], we may deduce[3] that for a Perseid meteor of visual absolute magnitude $-2 \cdot 0$, $q = 1 \cdot 25 \times 10^{15}$ ion pairs per cm., and for a Geminid of absolute magnitude $-3 \cdot 0$, $q = 1 \cdot 43 \times 10^{14}$ cm.$^{-1}$.

(iii) Millman[1] has given the mean height of Perseids and Geminids of absolute visual magnitude $+0 \cdot 5$ as 102·6 km. and 97·0 km. We may assume that these heights apply to the brighter meteors as well, and compute values of the diffusion coefficient, D, from the results of Greenhow and Neufeld[4].

Substitution of the values of sections (i), (ii) and (iii) and $t = 1 \cdot 0$s. in equation (1) yields the luminosity, I, of a cm. length of meteor train. These values are given in Table 1.

Table 1. Luminosity of Perseid and Geminid Meteor Trains One Second after Formation

	Absolute visual magnitude	I ergs/cm./sec. estimated from recombination	I_0 ergs/cm./sec. observed visually
Perseids	−2·0	1·22	400
Geminids	−3·0	3·82	400