THEORETICAL DECAY CURVES FOR DIFFERENT VALUES OF THE INITIAL INTENSITY AND FOR DIFFERENT TEMPERATURES

I' is strongly temperature-dependent and may be called phosphorescence in agreement with a suggestion put forward by Pringsheim[5]. I_0' is then the phosphorescence intensity extrapolated to $t = 0$.

r decreases during the decay to its asymptotic value R. At very low densities of excitation r_0 may be equal to R. The decay then reduces to one bimolecular curve. With increasing densities of excitation I_0' approaches an upper limit corresponding to $l_0 = L$ and $r_0 = 1$. The phosphorescence is then saturated.

At very low temperatures $I_0' = 0$. All traps are filled during excitation and the phosphorescence is then frozen in. The decay is bimolecular initially if $L \ll n$ but always changes to an exponential curve ($n - L \ll n$).

At very high temperatures when $\gamma \gg \beta L$, the whole decay is given by

$$I = \frac{\beta n_0^2}{(1 + \beta n_0 t)^2}. \quad . \quad . \quad (13)$$

This corresponds to the "Obere Momentanzustand" of Lenard.

It can be seen from formulæ (8) and (1) that this occurs if

$$T > \frac{E}{k} \frac{1}{ln \ s/\beta L}, \quad . \quad . \quad (14)$$

in our example if $T > 400°$ K.

At room temperature no phosphorescence will be observed if $E \ll kT \ ln \ s/\beta L$.

In our example this would have occurred for trap depths less than 0·35 eV.

Fuller details will be published elsewhere.

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Diffraction of Light by Ultra-sonic Waves of Very High Frequencies

USING a specially constructed rectifier giving 1,100 volts and a Taylor T 55 valve with amphenol bases and special inductances, frequencies up to 100 megacycles per second have been produced. A tourmaline plate prepared in this laboratory with a thickness of 2 mm. and a fundamental of about 2 Mc./sec. is made to oscillate up to its 54th harmonic, and at all stages it could be employed to maintain stationary waves in a column of water in the usual manner. Diffraction patterns at almost all the frequencies in the range 2 to 100 Mc./sec. could be observed. The highest frequency so far adopted[1] for such work is only 52·5 Mc./sec. In order to detect dispersion, if any, of ultra-sonic velocity in water, the crystal has been simultaneously excited by us at two frequencies and both patterns photographed on the same plate at the same instant.

Frequency measurement has been effected by beating the oscillator with a standard Philips heterodyne wave-meter, using an audio amplifier for hearing the beat note. Results for two frequencies are given below, the temperature of water at the time of the experiment being 32·6° C.

Order of harmonic	ν Frequency in megacycles per second	d Fringe width in cm.	ν/d	Velocity calculated in metres per second
5	9·465	0·3655	25·89	1526
49	92·28	3·569	25·86	1524

Results may be taken as indicating that there is no dispersion of ultra-sonic velocity in distilled water. Bär's values when extrapolated to 32·6° C. give a velocity of 1,523 metres per second.

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Symbiotic Aspects of Nitrification

IN an interesting article on the symbiosis between myxobacteria and nitrifying bacteria, Imsenecki[1] describes an observation which he made during his studies on the biology of myxobacteria, when he was able to isolate from a culture of *Nitrosomonas*, grown in its elective medium, a heterotrophic organism which he has named *Sorangium symbioticum*. He postulates a symbiotic existence for these two organisms, suggesting that the development of the nitrifying bacteria precedes that of the myxobacteria, and that these chemotrophic nitrifiers synthesize the organic material needed for the heterotrophic organisms, afterwards making this available by the autolysis of the *Nitrosomonas* cells. Unfortunately no quantitative data have been published[1].

Since the question of the metabolism of the nitrifying bacteria has evoked considerable interest in recent years, it was thought worth while to record the observations made by me in an attempt to correlate the rather incompatible phenomena of nitrification by the classical organisms described by Winogradsky as it occurs in artificial cultures and in their natural environment. The possibilities that the nitrifying bacteria function in close association with the saprophytes of the soil, and that the nitrifying organisms are themselves heterotrophic in some stage of their lives were examined. It was shown[2] that when *Nitrosomonas* was cultured in its elective medium in the presence of organisms well known to take part in the transformations of nitrogen in the soil, as *B. megatherium*, *B. mycoides*, *Azotobacter chroococcum*, etc., there was always enhanced nitrification in presence of added organic matter. These results question the strictly autotrophic character of the organisms tacitly assumed by Winogradsky and rather rigidly demonstrated by other workers. We have thus to assume that in mixed cultures, as in soil and sewage, the necessary carbon dioxide is obtained from the normal respiration of the heterotrophic