excellent description of the theory is given in a recent article by Webb.[4]

At first sight, photographic reversal does not seem to fit the Gurney-Mott theory of latent image formation. It seems that some process in addition to photoconductivity and electrolytic conductivity must go on. Mott[5] has suggested that photographic reversal (or solarization) produced by light is due to the reaction of bromine atoms released from the crystal lattice during the process of latent image formation with the silver of the concentration specks to form silver bromide which makes a coating over the grain. This protective coating screens the grain and the concentration speck on the surface of the grain from the action of the developer. Mott's explanation of reversal applies when the reversal is produced by x-rays. Obviously, if the protective coating of silver bromide can be removed from the grain, the developer can react with the concentration speck and the reversal will disappear. This removal can be accomplished by washing the film in ordinary hypo for a short time before development. The development should then blacken the grain that was reversed.

With the method of Baltzer and Nafe,[6] two films were exposed to x-rays under exactly the same conditions for one-half hour. Film *A* of Fig. 1 was developed in the normal way and showed reversal. Film *B* was left for five seconds in the fixer, then placed for a moment in a stop bath of water and acetic acid to halt fixation, and was finally developed and fixed. It is seen that reversal has been removed from film *B*.

Owing to the very small electrolytic conductivity of a silver bromide grain at liquid-air temperature, the Gurney-Mott theory indicates that photographic reversal should not occur at this temperature. We have so far been unable to obtain reversal with x-rays at liquid-air temperature even with exposures twenty-five times as long as the exposure necessary to produce reversal at room temperature.

We have found that reversal as produced by light can also be removed by preliminary washing in hypo. By exposing a strip of Eastman x-ray film to light from a three hundred-watt tungsten lamp placed twenty-four inches away, reversal was obtained in four seconds. A film having steps of different exposure time from one-half second to sixteen minutes was cut in two pieces. One-half was developed the normal way and the other half was fixed for five seconds, placed in a stop bath, and then developed. In the first film, density decreased with exposure beyond four seconds. In the prefixed film, density increased with increasing exposure time and showed no reversal.

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Pressure Effect on Infra-Red Absorption

Laboratory measures of the infra-red absorption by ozone-oxygen mixtures have been made[1] to afford a basis for reducing meteorological observations of the height of the atmospheric ozone. The meteorological observations, started over a year ago,[2] will be finished in a few months.

The new method of determining the height of the atmospheric ozone depends on simultaneous measurement of the absorption of ozone in the ultraviolet where the absorption is independent of pressure and in the infra-red at 9.6μ where the absorption is pressure dependent.

The laboratory measures of the infra-red absorption of ozone in the region of the apophyllite residual ray band centered at 9.66μ[3] are given in Table I for a path thickness of 2 mm ozone at NTP. Although the measures have been made at various thicknesses of ozone up to 5 mm and will be published later, the data at 2 mm illustrates the pressure dependence of infra-red absorption.

TABLE I. *Absorption of ozone-oxygen mixtures for the apophyllite residual ray band at 9.66μ. Path length 91.4 cm. Reduced thickness of ozone at NTP = 2 mm.*

Total pressure *P* in mm Hg	6	13	26	58	104	194	722
Percent absorption *A* percent	27.2	32.5	39.1	47.5	52.5	59.8	66.7

If we use these values and plot log *A versus* log *P*, it appears that the pressure dependence for the pressure range 6 mm of mercury to 104 mm of mercury is:

$$A = kP^{\frac{1}{2}}, \tag{1}$$

where k equals 0.174.

Assuming that the stratosphere is at a uniform temperature of $-50°$C we get a useful equation by combining the simple barometric equation with Eq. (1).

$$h - h_0 = 60 \log (A_0/A) \text{ kilometers.} \tag{2}$$

Here h is the "average" height of the ozone on a particular occasion when the thickness as determined by the ultraviolet absorption is x. A is the observed infra-red absorption by the ozone in the regions of the residual ray band of apophyllite. h_0 is the height of ozone on another occasion when an equal thickness of ozone absorbs A_0.

It is evident that the absorption of sunlight in the infra-red is unsuitable for accurately determining the amount of ozone overhead because of the pressure effect.

We have applied Eq. (1) to the measurements of Hertz[4] on CO_2 at 14.7μ and it appears that his data support such a formula better than a square root formula. Whether or not Eq. (1) applies generally to other gases is significant in calculating radiative heat transfer in the atmosphere. The pressure dependence for other atmospheric gases is now being experimentally tested.

The obvious inference to draw from Eq. (1) is that line broadening in the infra-red is proportional to the square root of the pressure.

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May 1, 1940.

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