and q_r are distances from the illuminating point source of wavelength λ_r to the hologram and from the hologram to the reconstruction, respectively. For resolution in the reconstruction plane, we require that the central maximum of the diffraction pattern due to one object coincide with the first minimum of the diffraction pattern due to the other. According to Myers[3], the angular separation; β, between these two is $\beta = 1.22\lambda/a$, where a is the effective aperture of the Fresnel zone pattern being used. These considerations lead to

$$y = \frac{1.22\lambda_a q_a M}{a_r}$$

Thus, the minimum resolvable distance y seems to depend upon the wavelength λ_a of the analysis, and the aperture a_r of the Fresnel zone pattern used in the reconstruction. So far, the expression does not contradict what the usual lens criterion would lead one to believe.

However, two real factors which limit the aperture of the zone pattern are the resolving power N of the film used in the analysis, and the width d of the real illuminating source. I consider two limiting cases.

Case 1. Point source and film of resolving power N cm^{-1}. This leads to a minimum resolvable distance

$$y_1 = \frac{0.61\ (m - 1)}{mN}$$

where $m = p_a/q_a$, which is independent of the wavelengths λ_a and λ_r. It predicts good resolution for $m \rightarrow 1$ (object close to source) and a reasonable result for $m \rightarrow \infty$ (contact print). The factor M does not appear.

Case 2. Grainless film and illuminating source of width d cm. This leads to a minimum resolvable distance, $y_2 = 1.22d/m$. Again the result is independent of the wavelengths used. A large m(object close to film) and a small d are indicated. The factor M does not appear. These results proceed from the following inequalities, which are necessary conditions for making a hologram in which the first n central bands are adequately recorded:

$$p_a\lambda_a > \frac{8d(n + 1)}{2N}$$

$$m - 1 > \frac{8d^2(n + 1)}{p_a\lambda_a}, \quad m - 1 < \frac{4N^2p_a\lambda_a}{8(n + 1)}$$

For x-rays, where $p = 500$ cm, $\lambda_a = 10^{-8}$ cm, $d = 10^{-3}$ cm, $N = 10^4$ cm^{-1}, $n = 5$, and values of m are dictated by the above inequalities, we get $y_1 = 5.53 \times 10^{-5}$ cm and $y_2 = 2.86 \times 10^{-5}$ cm. These would be useful resolvable distances.

The above results and empirical observations on x-ray exposure times seem to indicate that it is feasible to obtain Gabor reconstructions with x-rays. They also point to the possibility of making a Fresnel zone pattern by interference methods with visible light. This zone pattern might be reduced photographically and deposited on an optical flat of beryllium to yield a useful single zone plate for x-rays.

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1. [50R1]
2. [49G1]
3. Myers, jun., Ora E., *Amer. J. Phys.*, **19**, 359 (1951).

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