Topic 7: The Photographic Process.

Aim

This lecture covers the basis of the photographic processing and the optical properties of film including the relation between transmission and exposure for incoherent and coherent light.

References

- Goodman **Chapter 7**

- Guenther, page 475-478.

- Dainty & Shaw, *Image Science*, Adademic Press 1974 (detailed reference book).

7 Photographic Properties

Short set of questions on the photographic process all exploring the relation between exposure and transmittance. Questions 1, 2 and 4 are essential to the course.

7.1 Image of a disc

Show that for an image of a distant disc of constant intensity the intensity on the film plane is

$$\propto \frac{1}{F_{No}^{2}}$$

and hence that the exposure

$$E \propto \frac{\tau}{F_{No}^{2}}$$

where τ is the exposure time.

Hint: consider light from the object causing an approximately constant intensity across the aperture of the lens.

7.2 Film Gamma

For a film of $\gamma = 1.3$ the image of a region of constant intensity has an OD of 0.5 when photographed with an $F_{No} = 4$ and an exposure time of $1/125$ of a second. What is the OD of the image of the object when photographed with an $F_{No} = 16$ and an exposure time of $1/2$ second.

Hint: Use Q 7.1, whether you can show it or not.

7.3 For Photographers

Your camera is equipped with a $F_{No} = 2$ lens, and you find that your normal speed film of 100ASA is giving you an exposure or 1/8th of a second with the aperture full open at $F_{No} = 2$.

You decide that this film is too slow and change the film for a 1600ASA ultra fast film. If you set the camera speed to 1/60th of a second, what aperture setting should you use.

Hint: Use the fact that ASA is linear with Exposure and the result from question 7.1. Owners of a "real camera" (one where you can set film speed, aperture/exposure and check it with the built-in exposure meter), can can verify this result for themselves.

7.4 Photograph of PSF

You want to form take a photograph of the ideal PSF of a lens so that the third subsidiary maxima is *just* above the fog level without saturating the central peak. The available film has a dynamic range (ΔD), of 2.2. Estimate the γ to which the film should be processed.

The third subsidiary maxima of the ideal PSF has an intensity of 0.16% relative to the central peak. (see section 3, OHP 12).

7.5 The Pinhole Camera (again)

You want to "actually" use the pinhole camera specified in question 7.1 to take a photograph using 400ASA photographic plate. On a bright sunny day you find that you obtain a good exposure with a "normal" camera using with an exposure time on 1/500th of a second with the aperture set to $F_{No} = 8$ when using a 100ASA film. What exposure time would you need with the pinhole camera under the same conditions and comment.