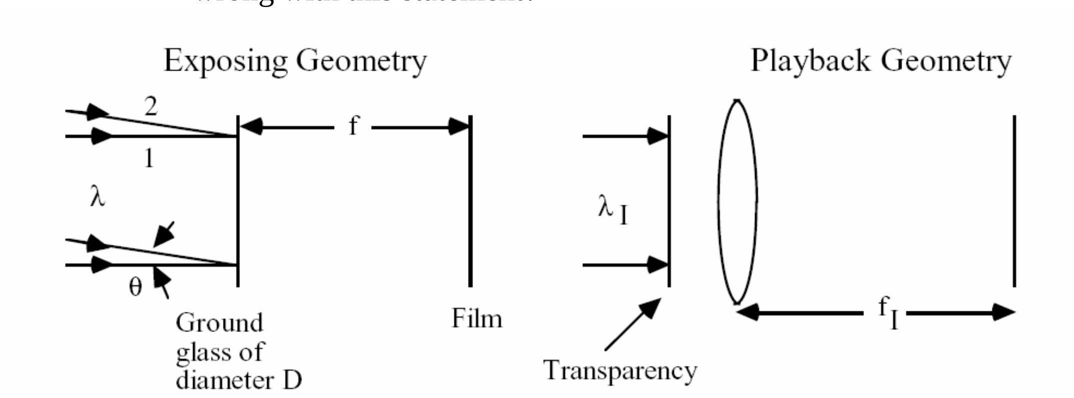
S-A1) A rough object is illuminated with a 0.5 μm wavelength laser beam. The object is 100 mm from a 50 mm focal length lens. If the diameter of the stop in the back focal plane is 5 mm, what is the average size of the speckle in the image?

S-A2) A piece of ground glass of diameter D is illuminated normally with a monochromatic collimated beam of wavelength λ, and the resulting speckle pattern is recorded on film a distance f away. A second recording of the resulting speckle pattern is made for the collimated beam incident at an angle θ. Assume that after processing, the amplitude transmittance of the film is proportional to the exposing irradiance. The resulting film transparency is illuminated with a collimated plane wave of wavelength λ_I. A lens of focal length f_I is placed after the transparency and the light distribution in the focal plane of the lens is observed. In answering the questions, you can assume small angles, if you wish.

a) What is the relationship between the fringe spacing observed in the focal plane of lens f_I and θ, D, f, λ, λ_I, f_I, and other pertinent quantities?

b) How many bright fringes can be observed in the focal plane? What is the minimum value θ of such that a bright fringe is observed at the center and edges of the pattern?

c) The results of this question imply that as far as resolution is concerned, all astronomical telescopes can be replaced with ground glass optics. What is wrong with this statement?



S-A3) A 1 cm diameter laser beam with 650 nm wavelength illuminates a rough surface. An observer looks at the illuminated surface and observes a speckle pattern superimposed with the illumination. As the observer moves his head in one direction, the speckle pattern moves in the opposite direction. Is the observer near sighted or far sighted? Justify your answer.