

# **Close-up and Macro Photography**

# Macro Photography

- The classical definition is that the image projected on the "film plane" (film or digital sensor) is the same size as the subject – 1:1.
- Finished photograph (print, on screen or projected image) greater than life size.
- Macro photography is often confused with close-up photography.

- Most 'macro' lenses achieve at least 1:2, that is to say, the image on the film is  $1/2$  the size of the object being photographed.



















# Macro Problems

- Close working distance.
- Low light entering camera
  - Difficult to focus dark image in viewfinder.
  - Long exposures.
- Shallow depth of field.

# Equipment - General

- Camera with Live View (swing-out screen)
- Compact cameras (rarely true macro, wide angle)
- Close-up lenses
- Extension tubes
- Bellows
- Reversed lenses
- 'Macro' lenses



# Equipment 2

- Tripod
- Focussing rack
- Ring flash
- Speedlight (as slave)
- Cable release, or self-timer
- Lab Jack, Plamp, etc.



Compact Camera



Full-frame DSLR







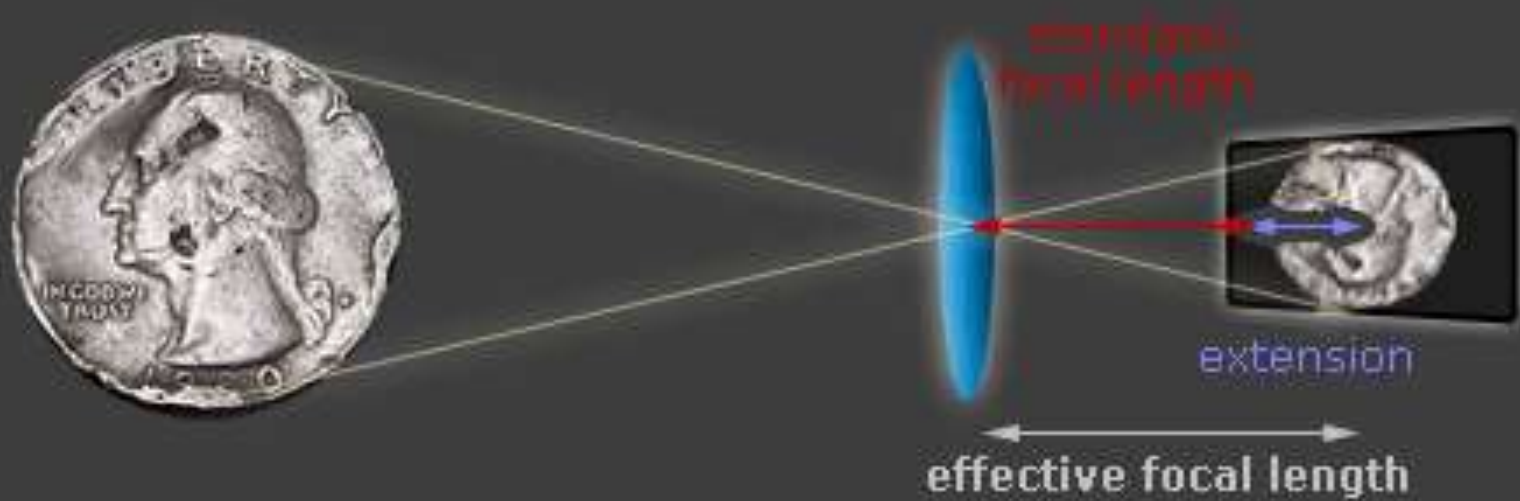
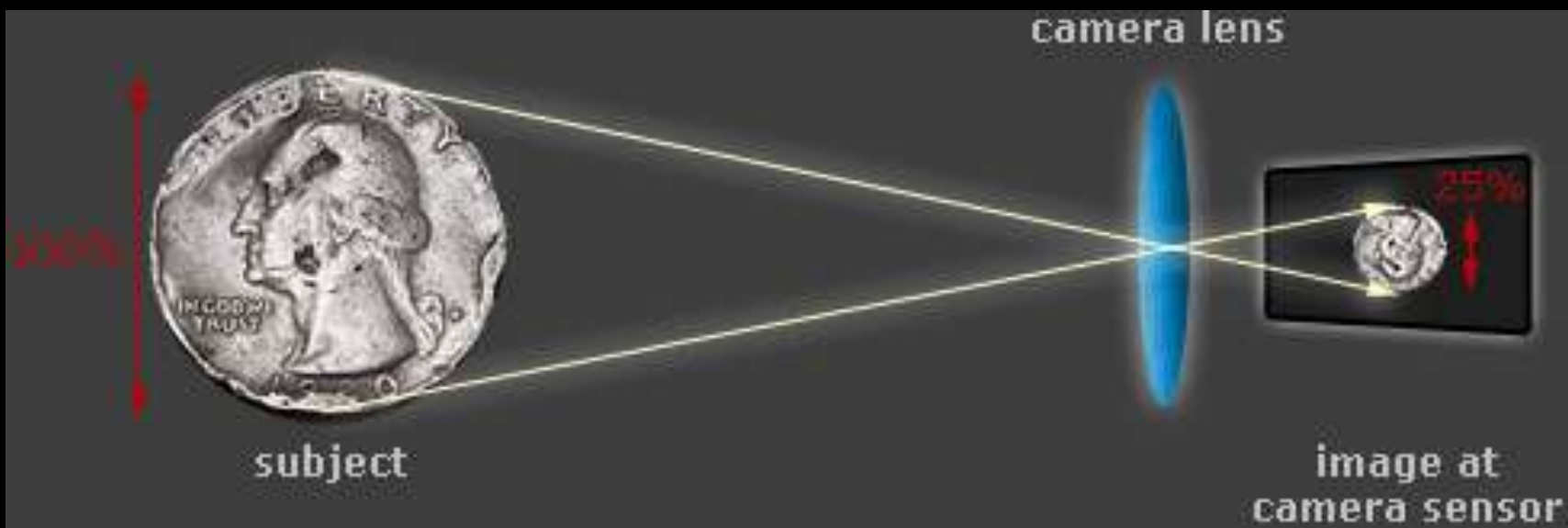
Pentax Optio compact camera, micro mode (1-2 cm)











Bellows + reversed lens





## Macro lens

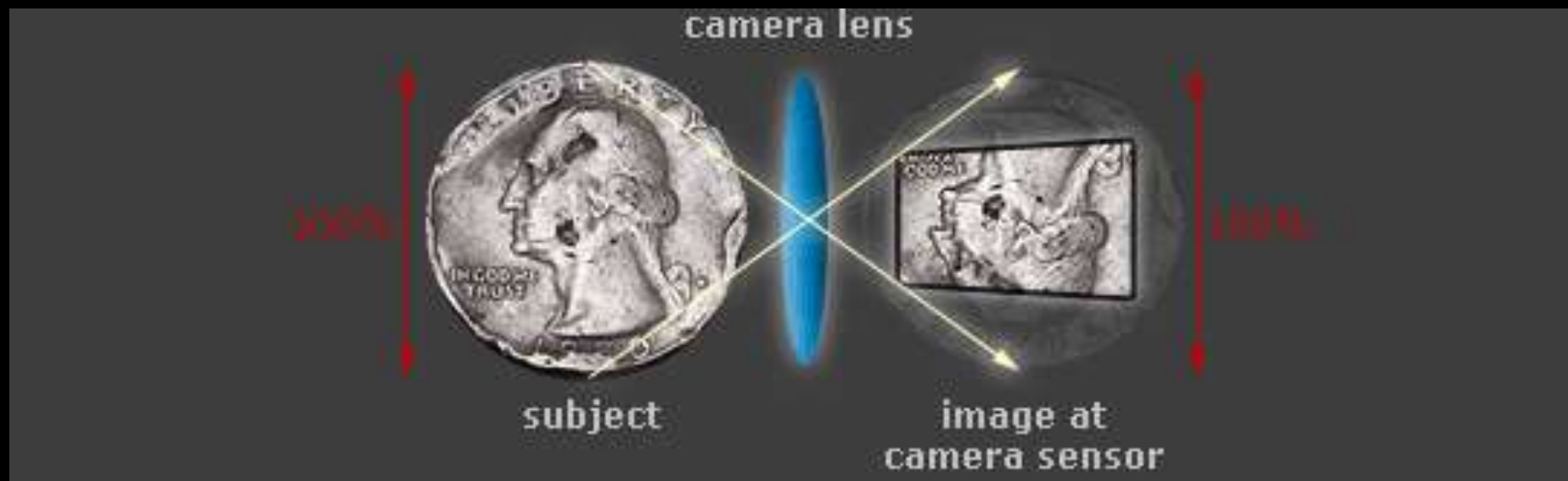
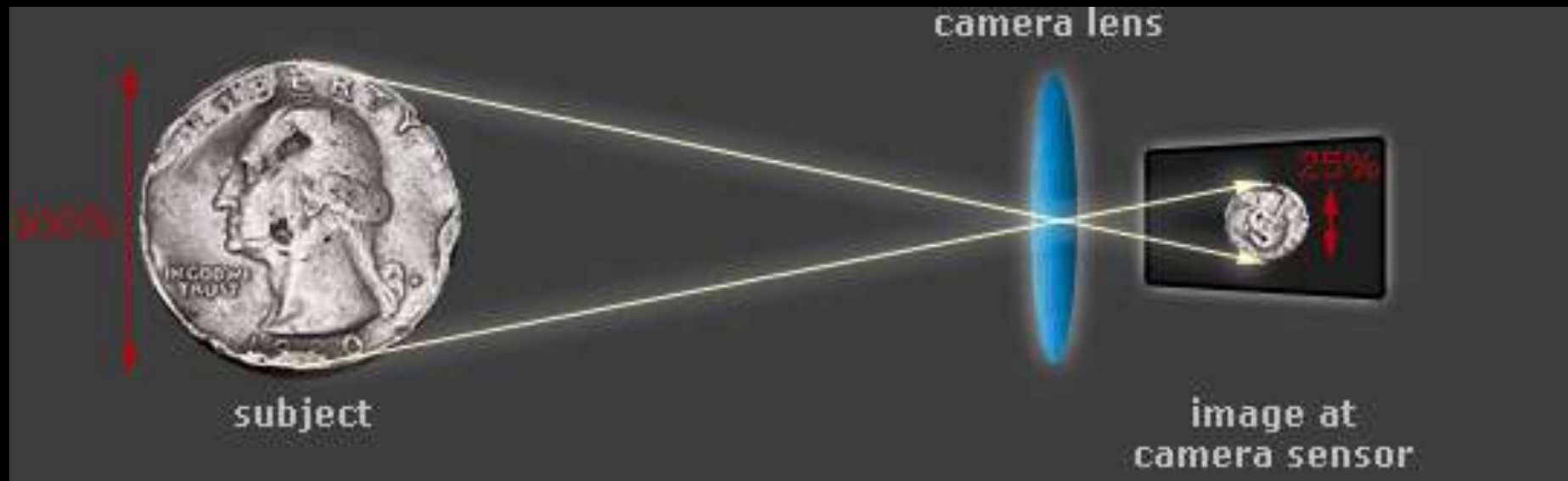
Focal length?

Internal or  
external focus  
adjustment?

**Only 'macro' at  
closest  
focusing  
position!**



# Closest Focussing Distance











Zoom 50 mm closest focus



50 mm macro, closest focus, 1:1









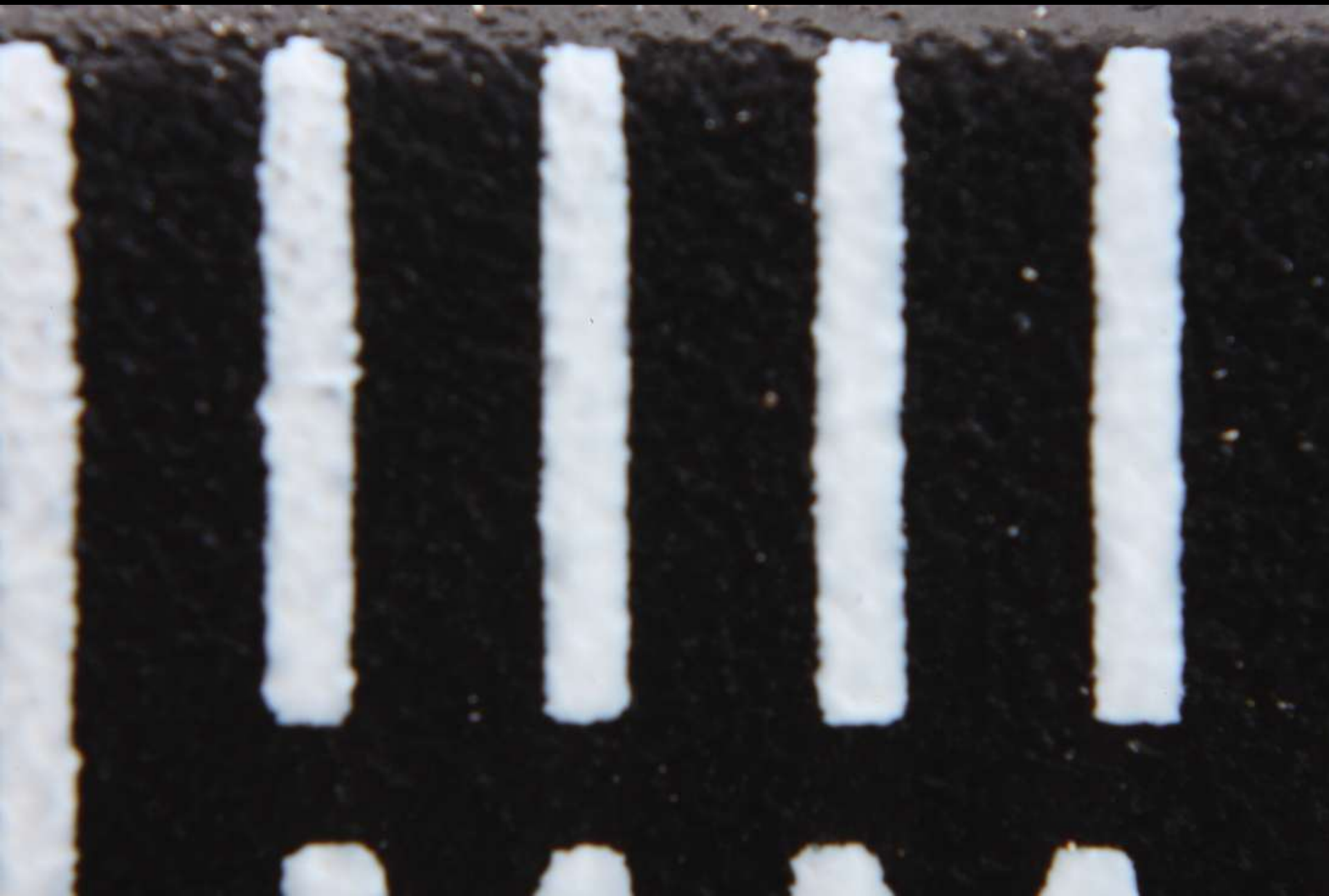


MPE-65 1:1 magnification on sensor (full frame)





MPE-65 7.5:1 magnification on sensor (full frame)











Reversed lens (auto)



Zoom 50 mm reversed, 1:1



Zoom, 28 mm reversed, 2.3:1 (2.3 x)





Zoom, 28 mm reversed + 42 mm extension tubes, 4.4:1 (4.4 x)









Zoom, 100 mm + 50 mm reversed, 1.9:1 (1.9 x)



Zoom, 300 mm + 50 mm reversed, 5.8:1 (5.8 x)









DEPTH OF FIELD

DEPTH OF FIELD

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DEPTH OF FIELD

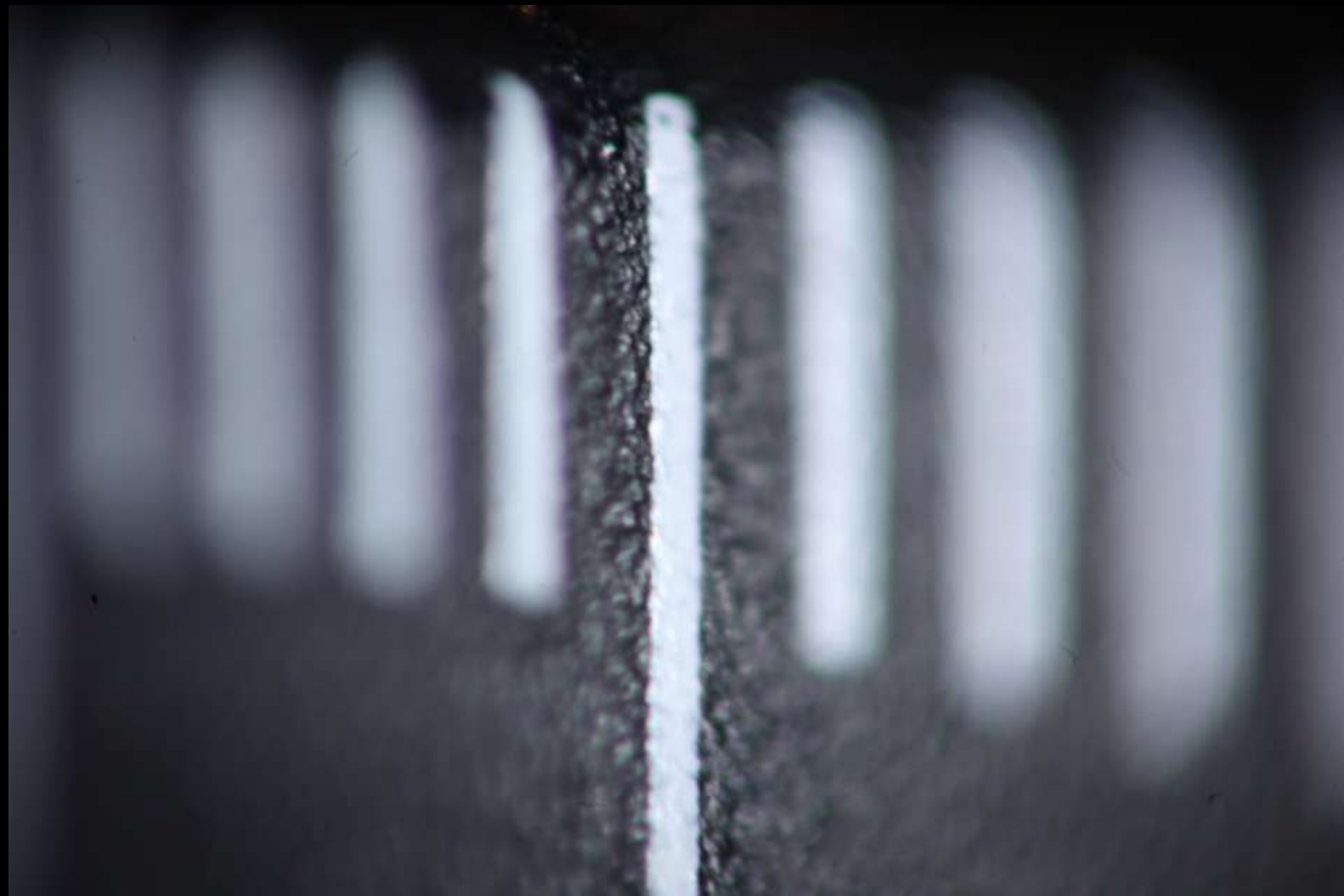
DEPTH OF FIELD

DEPTH OF FIELD

DEPTH OF FIELD

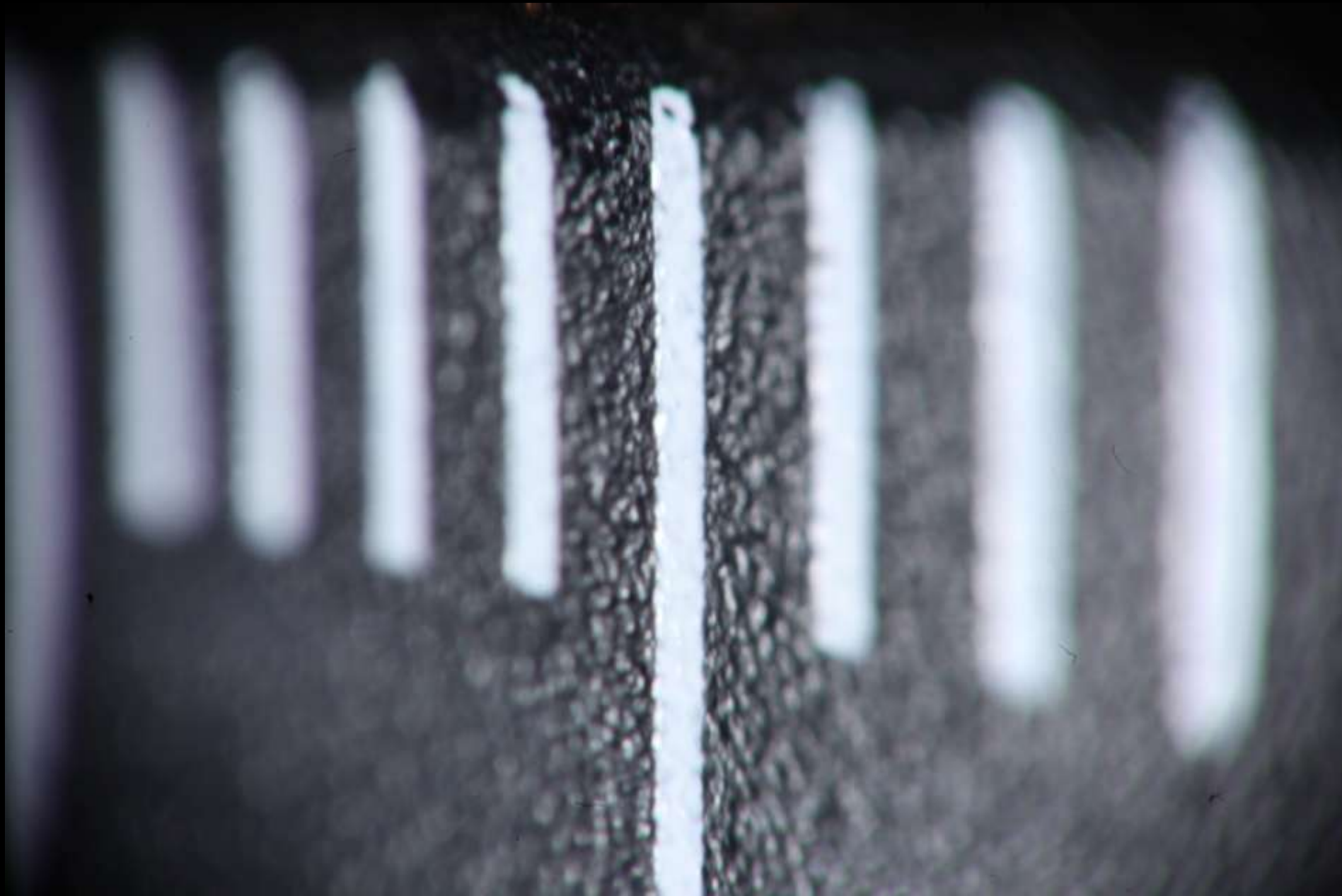
DEPTH OF FIELD

Zoom, 300 mm + 50 mm reversed, f5.6, DOF = 0.25 mm





Zoom, 300 mm + 50 mm reversed, f32, DOF = 0.6 mm



# Aperture, Depth of Field (DOF) and Diffraction



3.5

9.5

32



3.5



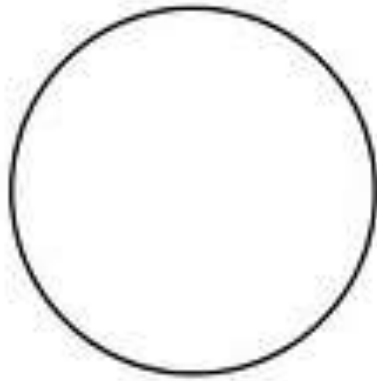
9.5



32



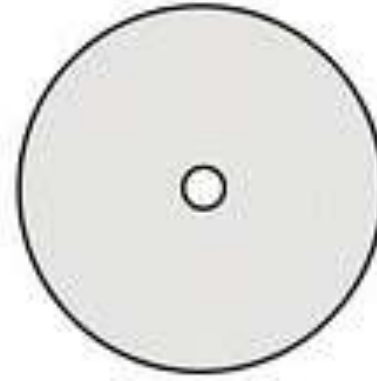
### Illustration of Aperture Settings



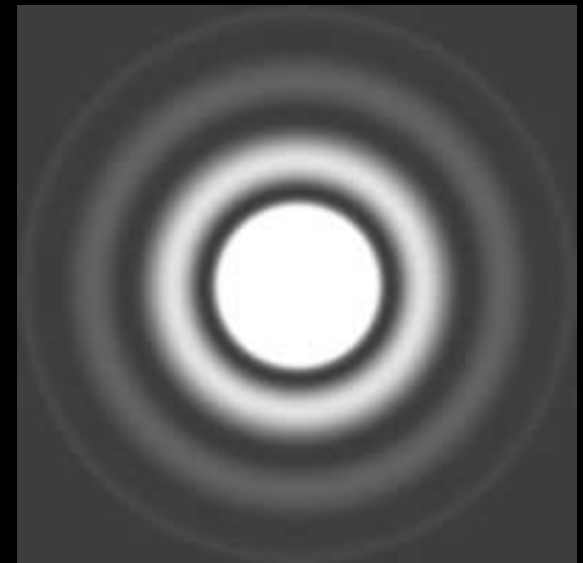
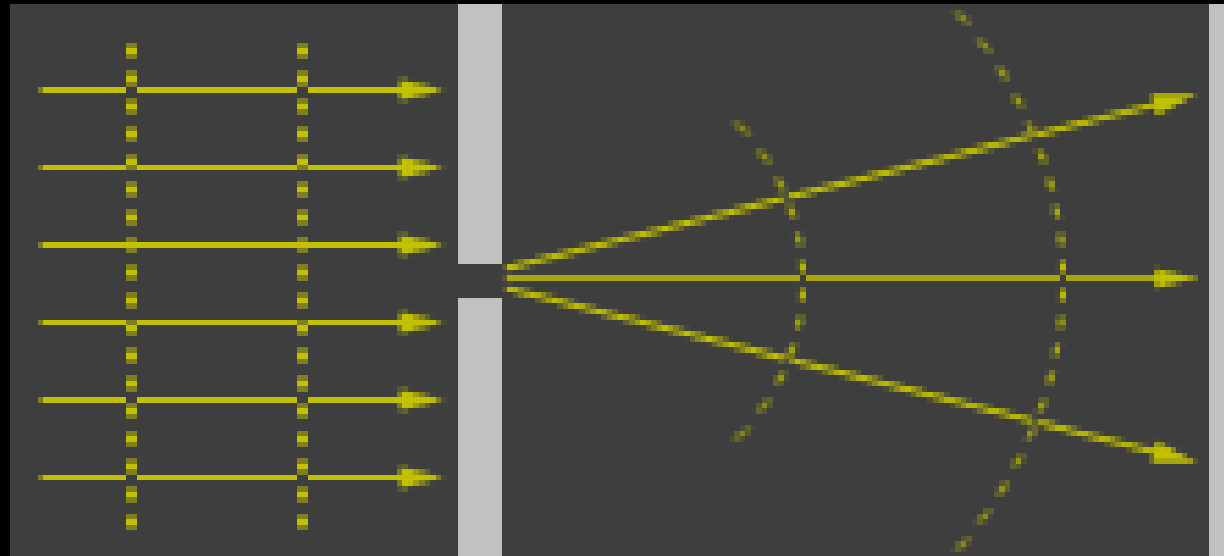
f2.8 Large

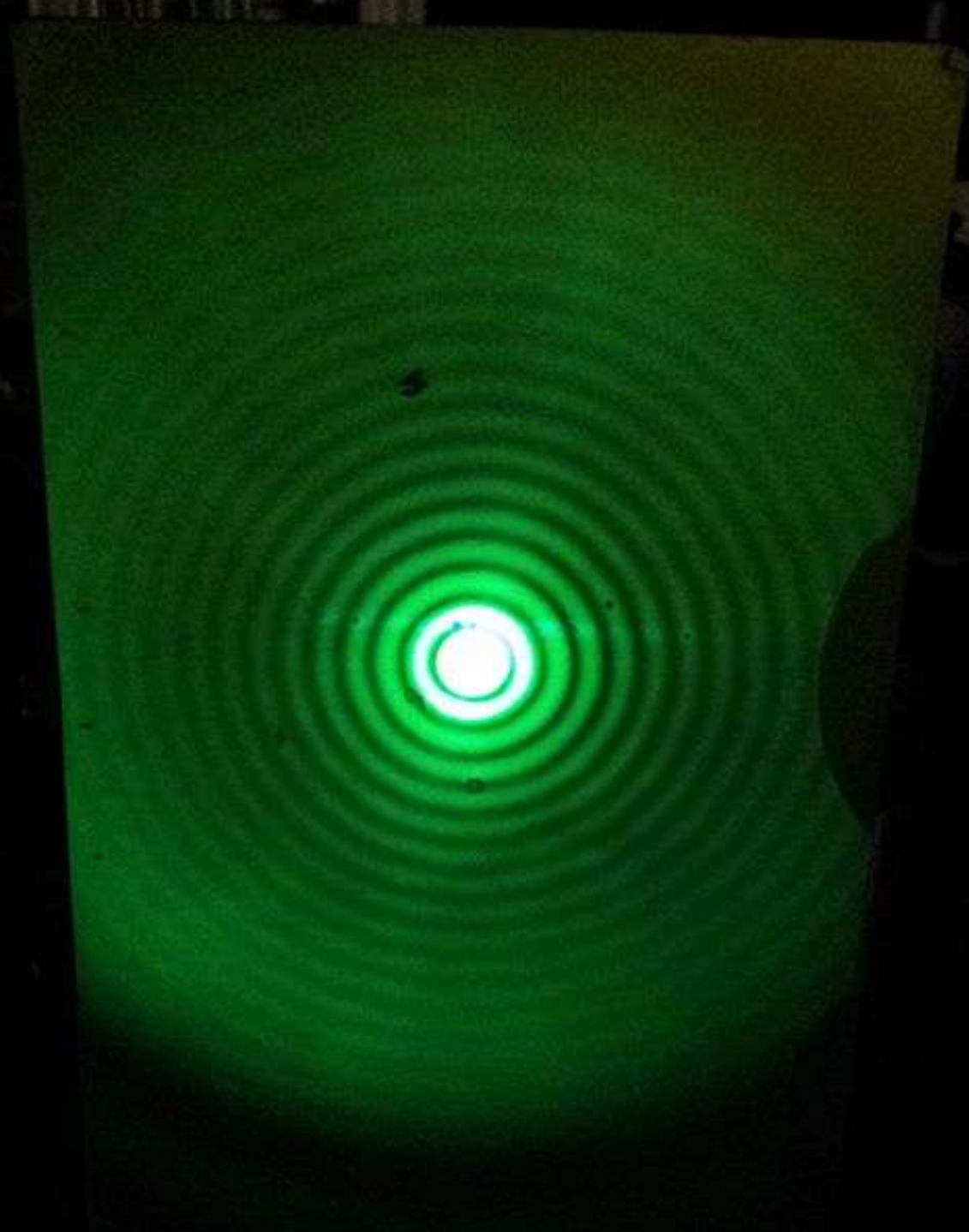


f11 Medium



f22 Small





## Airy Discs



(a)

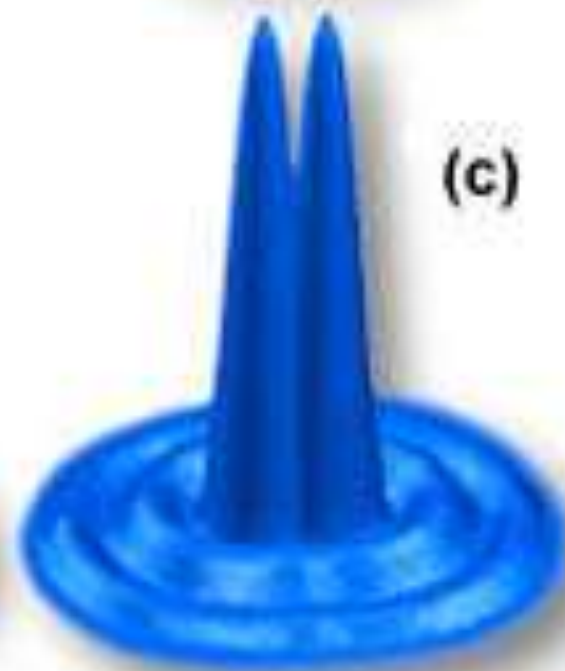
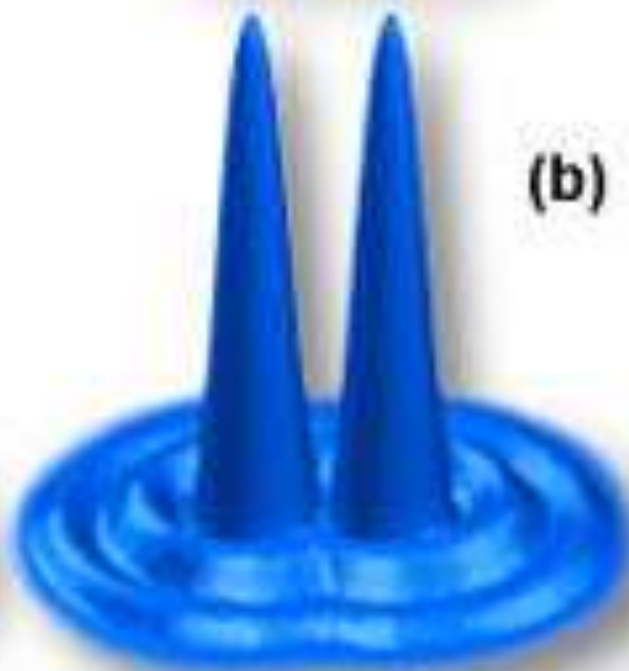
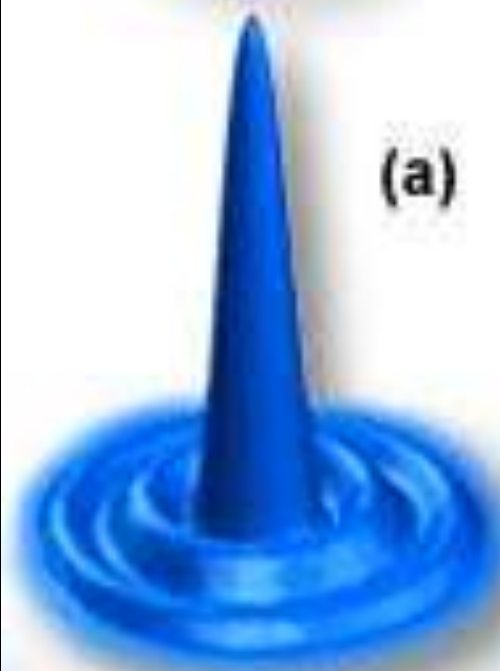


(b)



(c)

Intensity Distributions







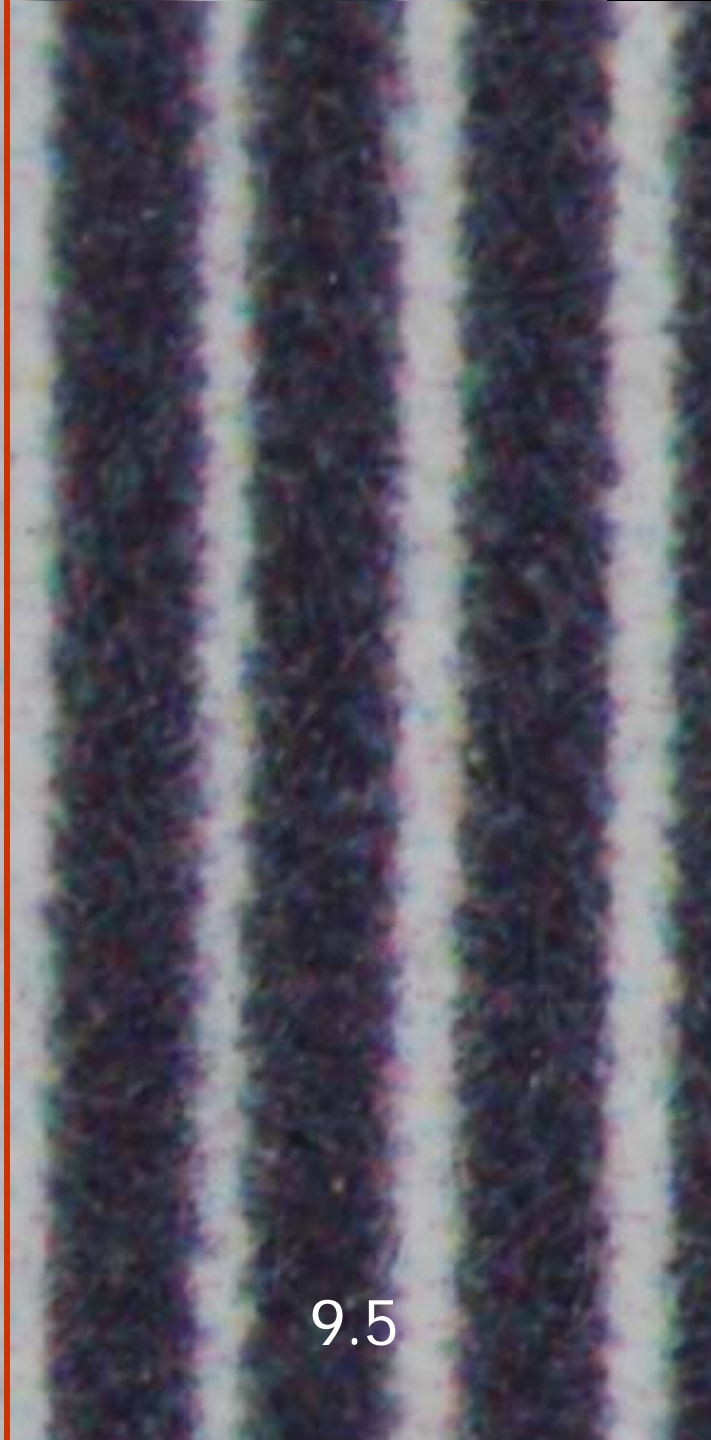
3.5



9.5



32



# Resolution – diffraction- or lens-limited?

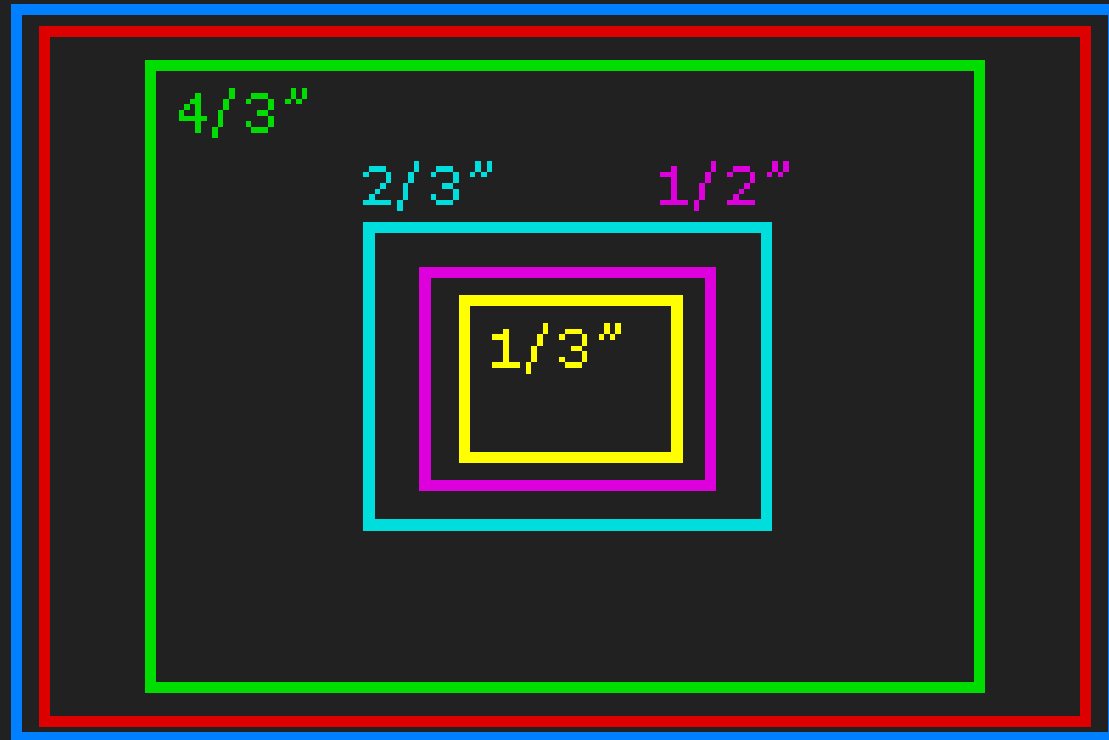
Sensor size	Onset of Diffraction
Full Frame	f22 – f32
APS-C	f16 – f22
Four Thirds	f11 – f16
Compact	f4 – f5.6



Full-Frame 35 mm Sensor

1.5X Crop Factor

1.6X Crop Factor



APS-C Sized Sensors

36 mm

24 mm



FOCUS STACKING







Closest Focus



Most Distant Focus



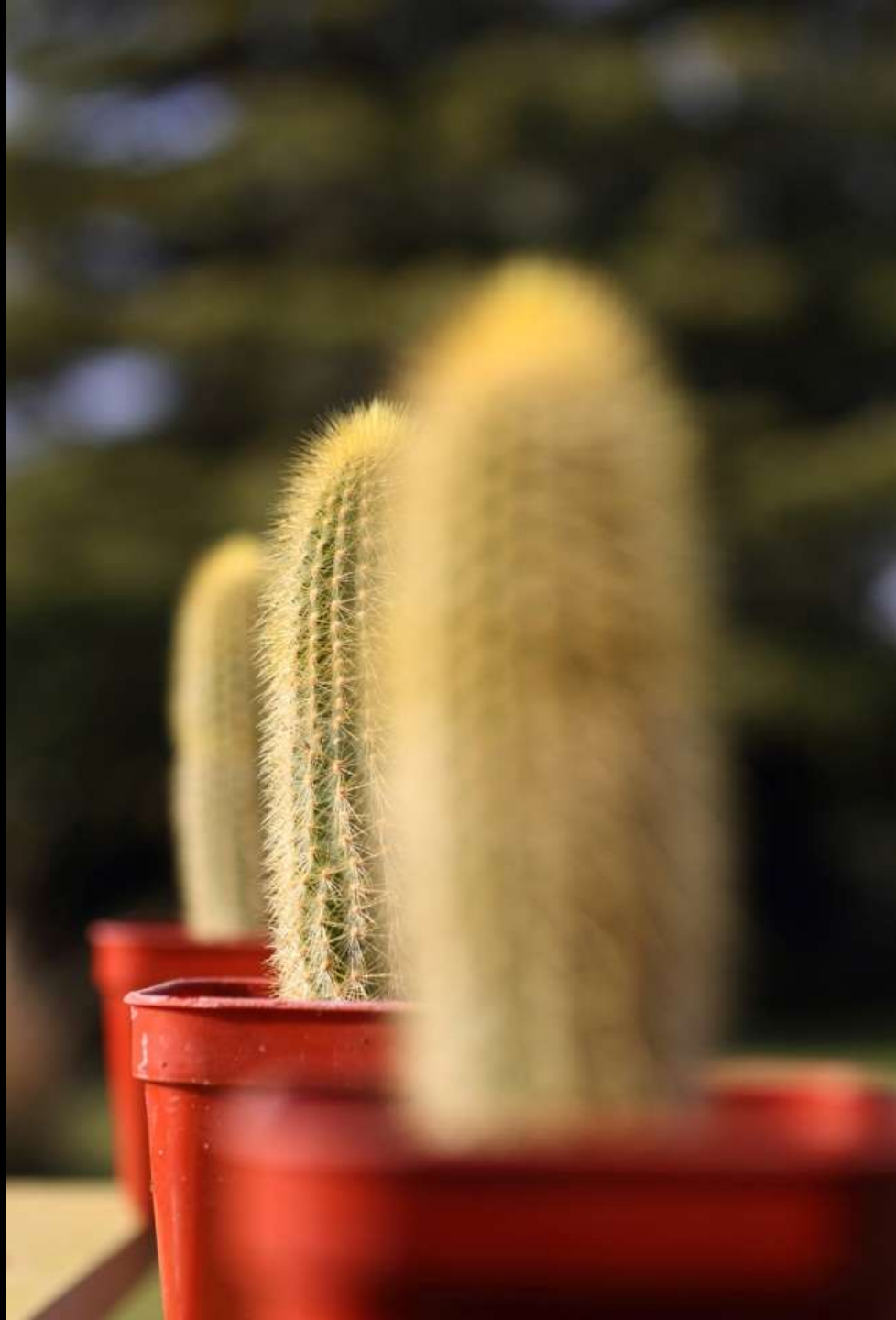
Focus Stacked



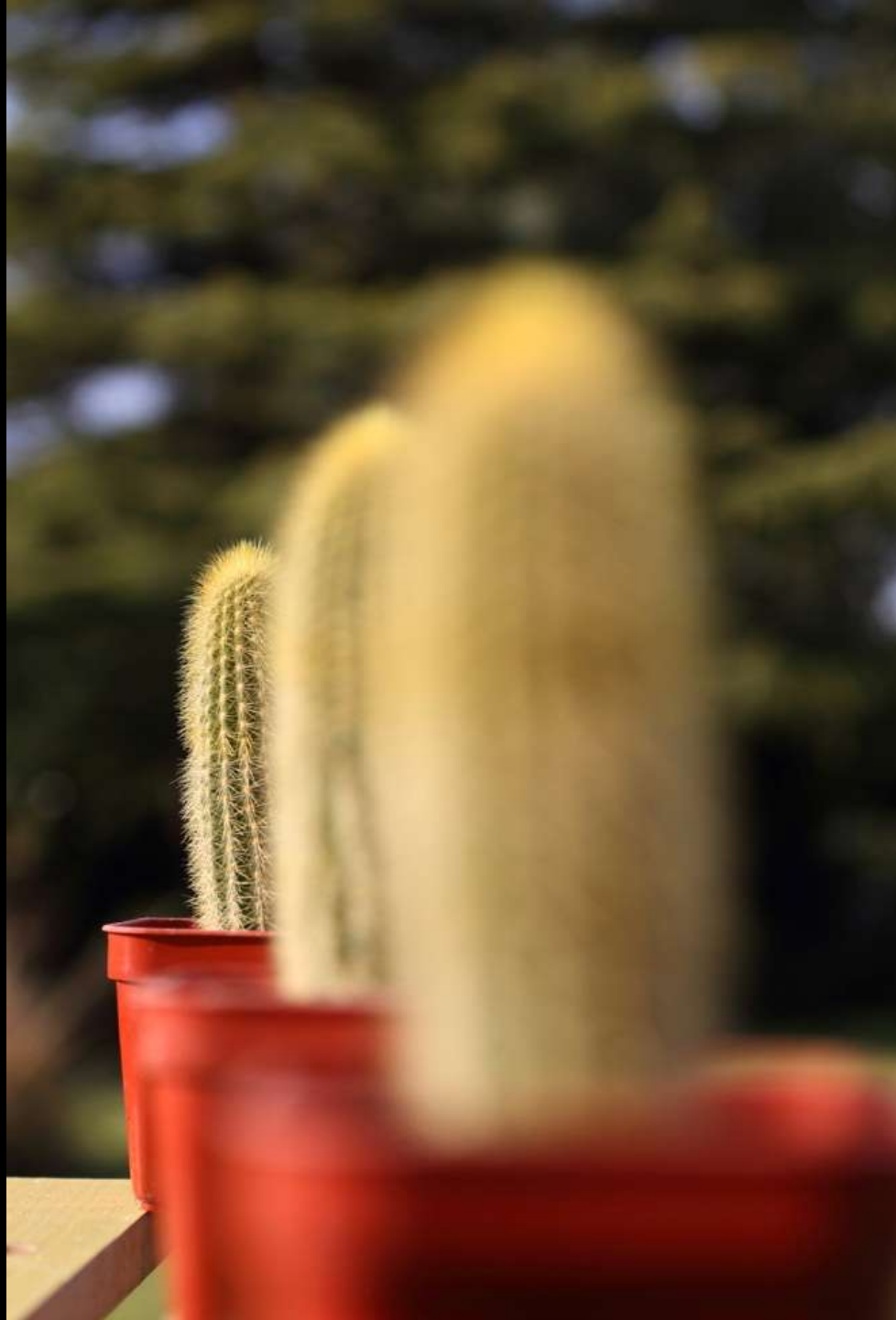






















# Software for Focus Stacking

- Photoshop CS4 or above
- Combine ZP
- Zerene Stacker
- Helicon Focus + Helicon Remote















