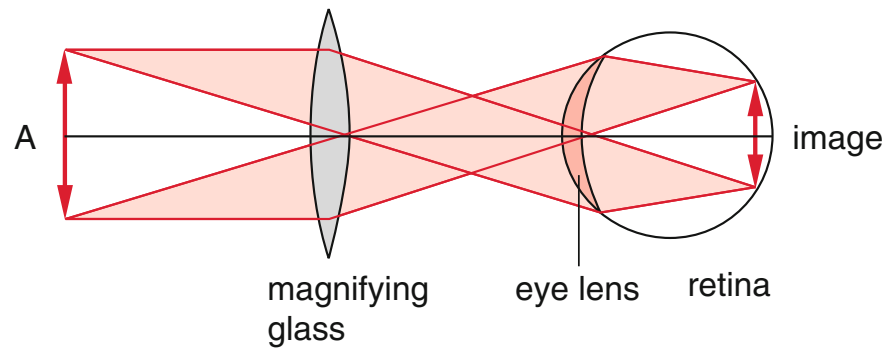


Experimental Physics 3 - Em-Waves, Optics, Quantum mechanics

Lecture 5

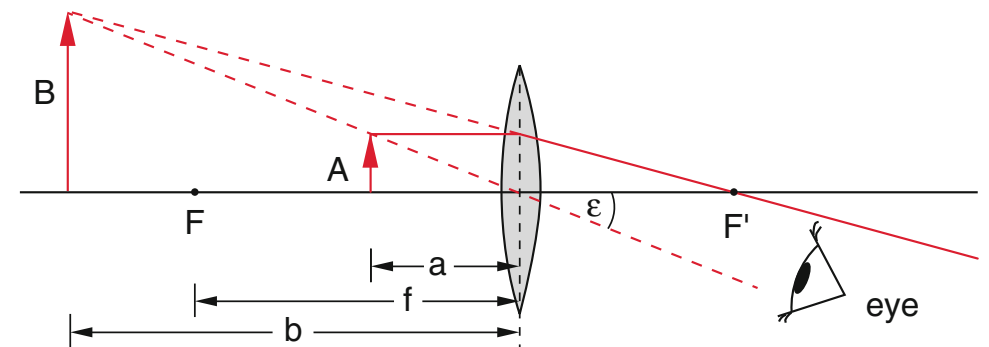
Magnifying Glass

In focus



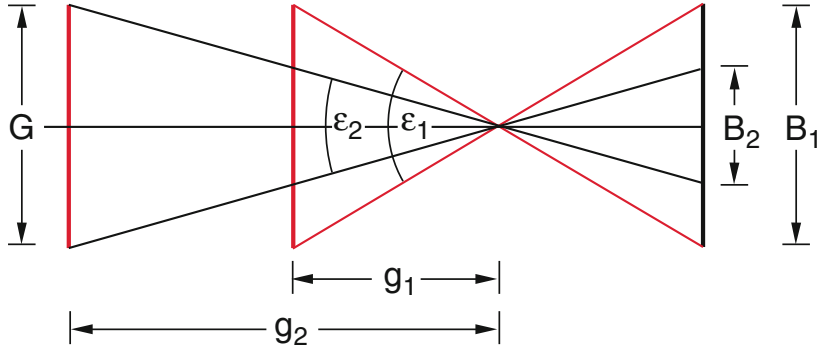
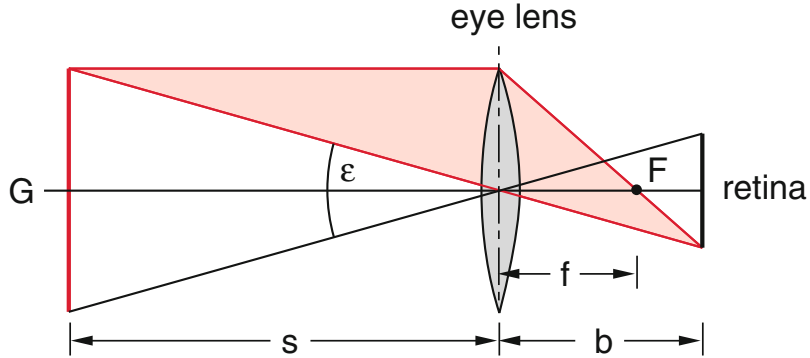
$$V_M = \frac{\tan(\epsilon)}{\tan(\epsilon_0)} = \frac{s_0}{f}$$

within focal range

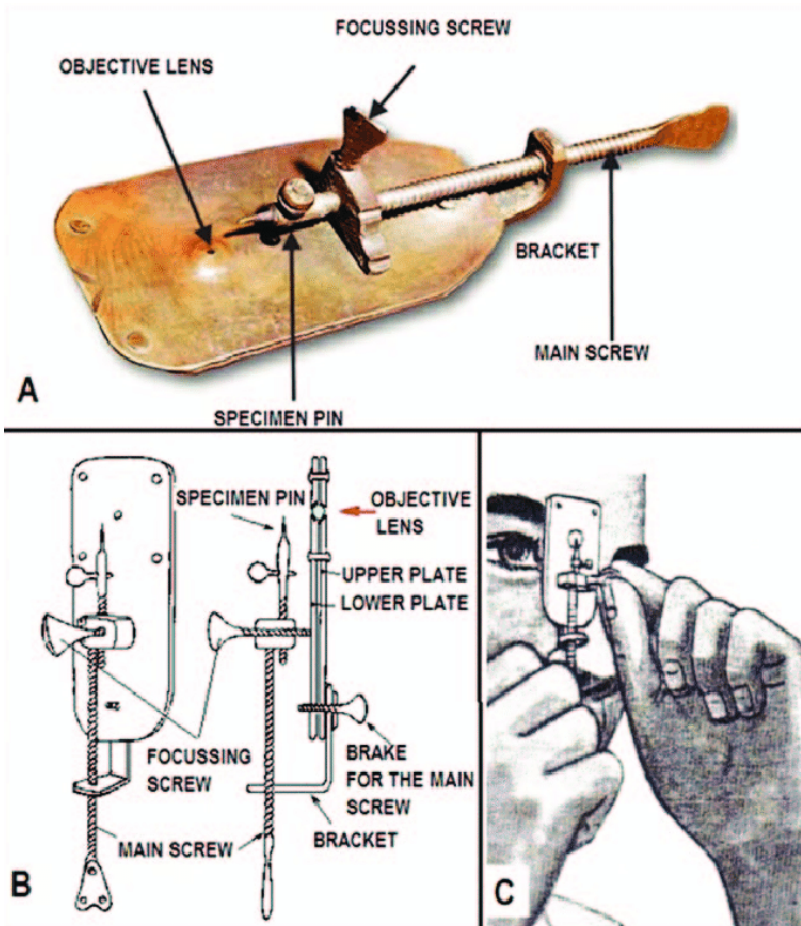


$$V_M = \frac{\tan(\epsilon)}{\tan(\epsilon_0)} = \frac{s_0}{a} = \frac{s_0}{f} + 1$$

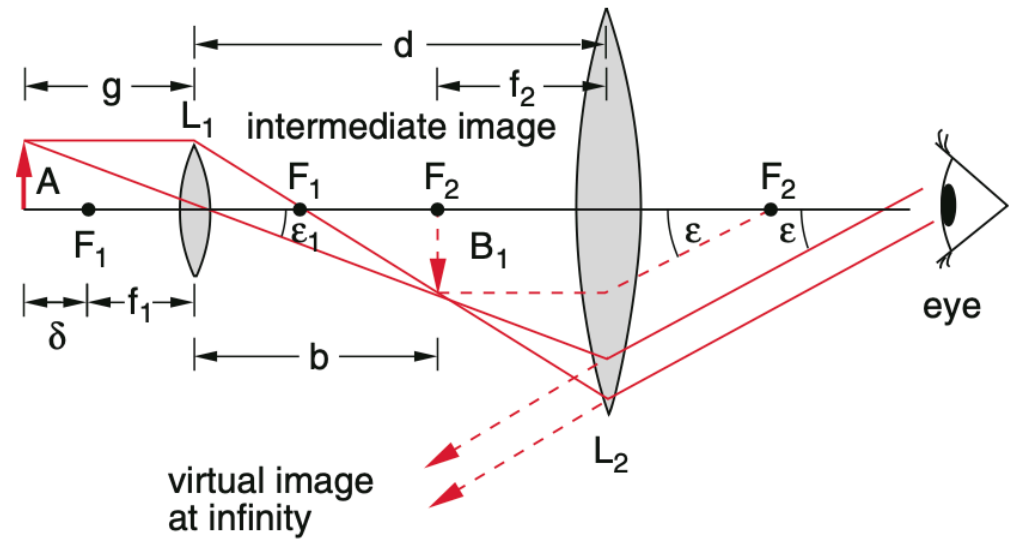
Visual Angle



Microscope



objective lens eye piece



$$V = \frac{(d - f_2)s_0}{f_1 f_2}$$

Objective Lens - Eye piece

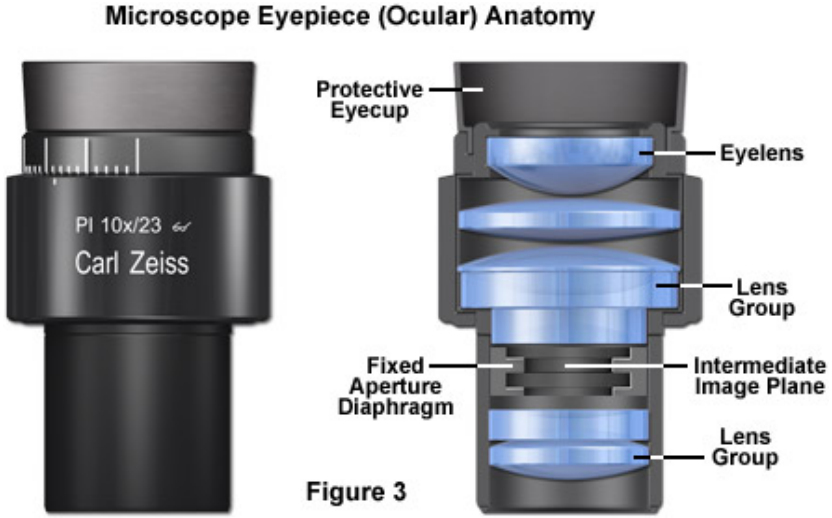
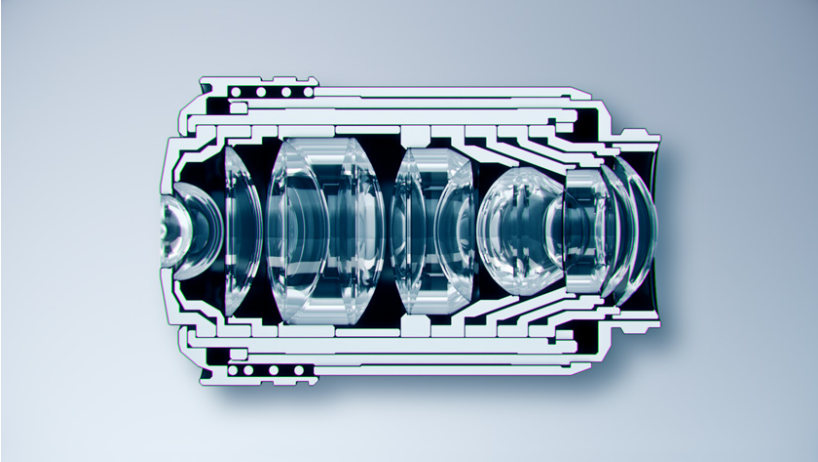
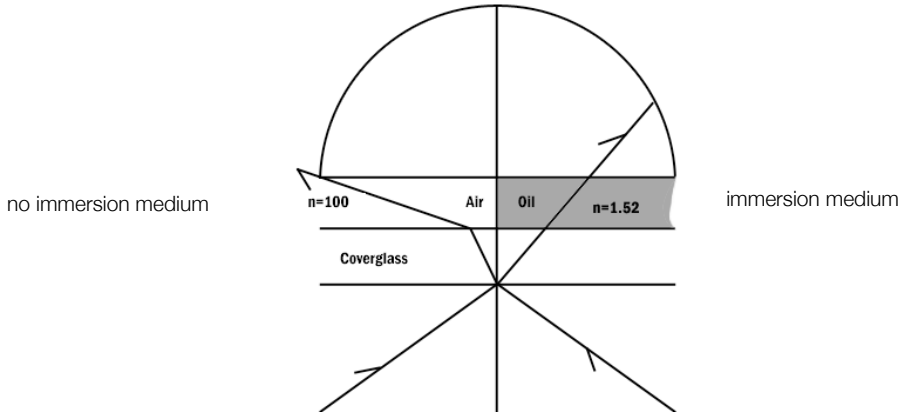
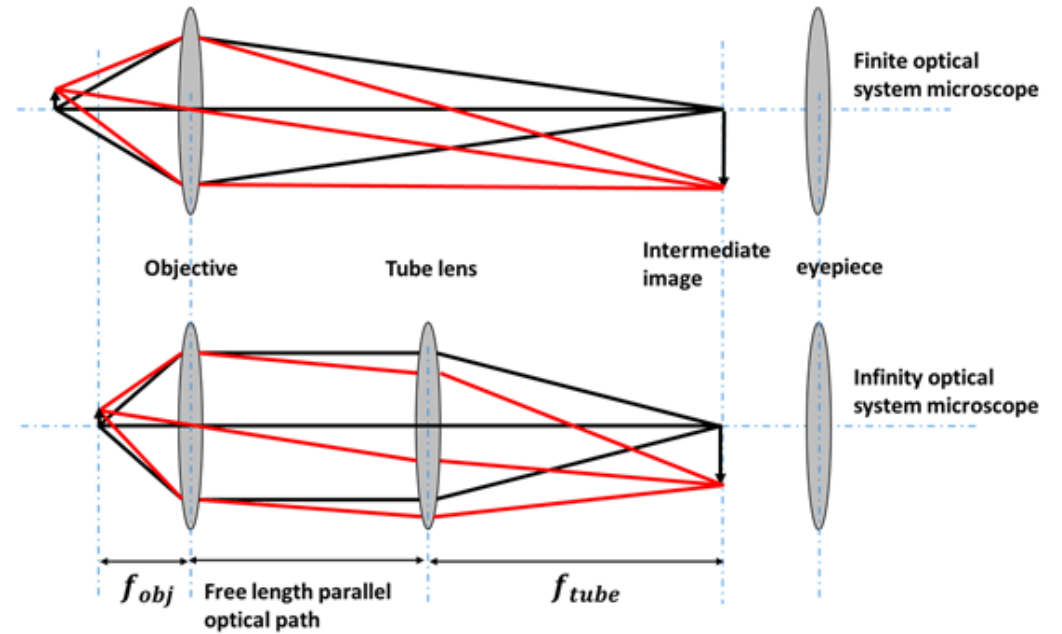
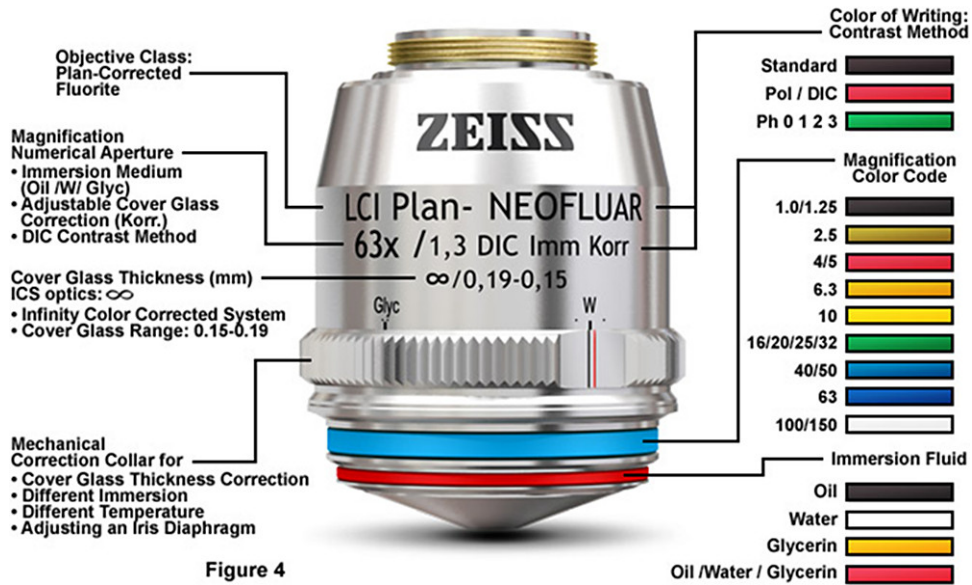


Figure 3



Infinity Optics

Deciphering Microscope Objective Specifications



Wiedfield Microscopy



Eyepiece
(Ocular Lens)

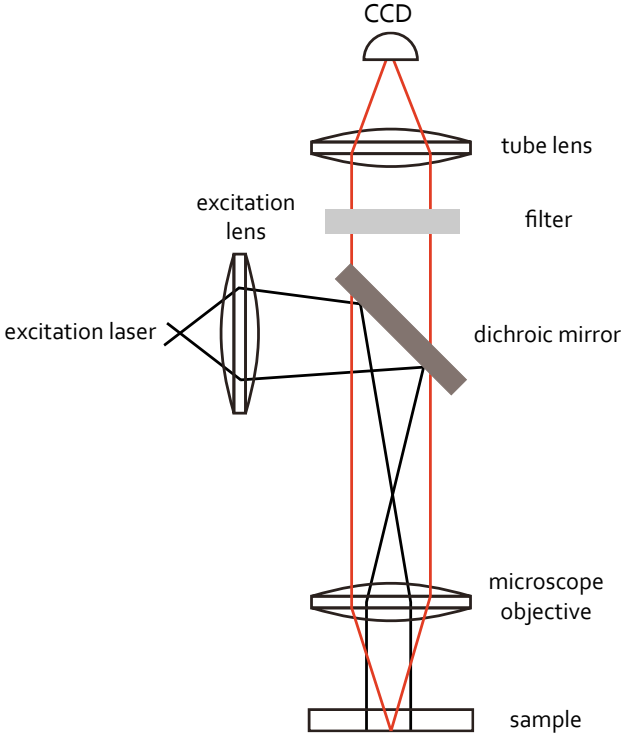
Objectives

Stage

Condenser

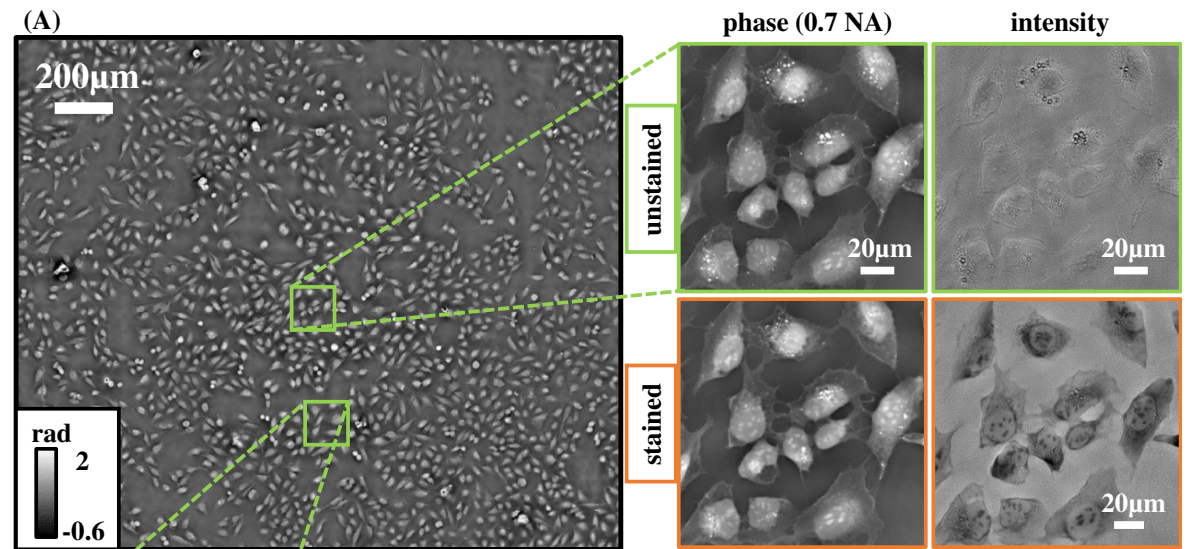
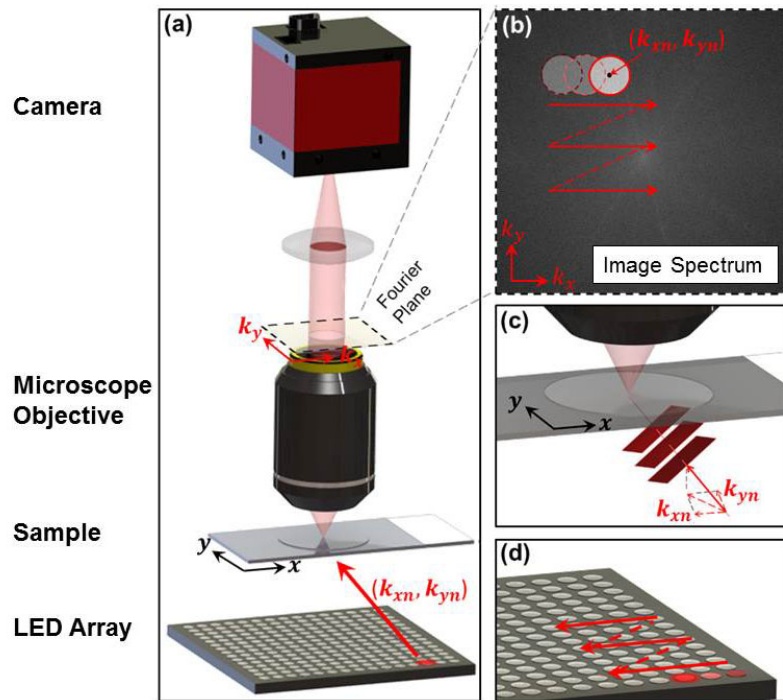
Light Source

Coarse and
Fine Focus
Adjustment



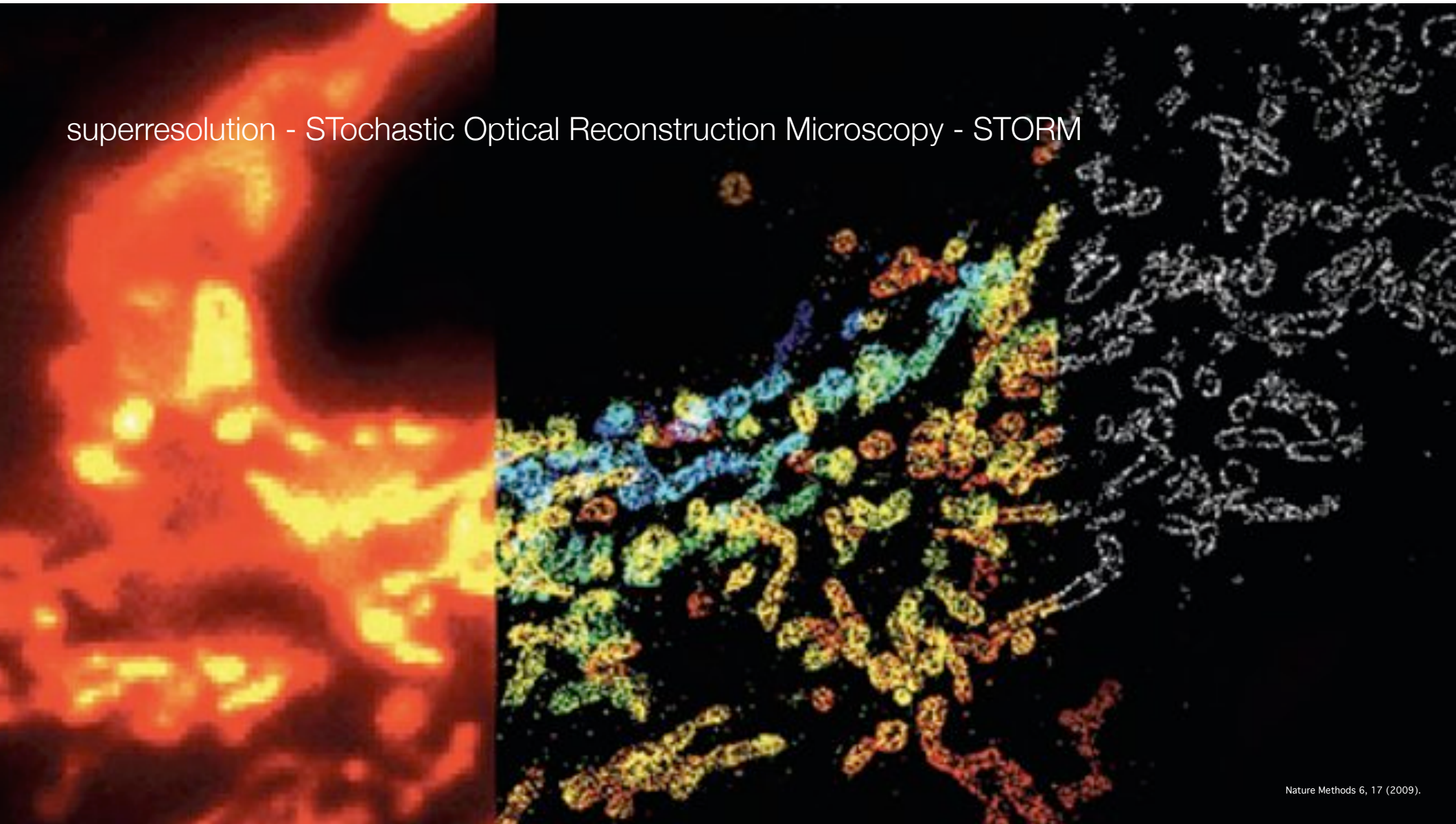
Optical microscopy techniques - just a glimpse

Ptychographic Imaging

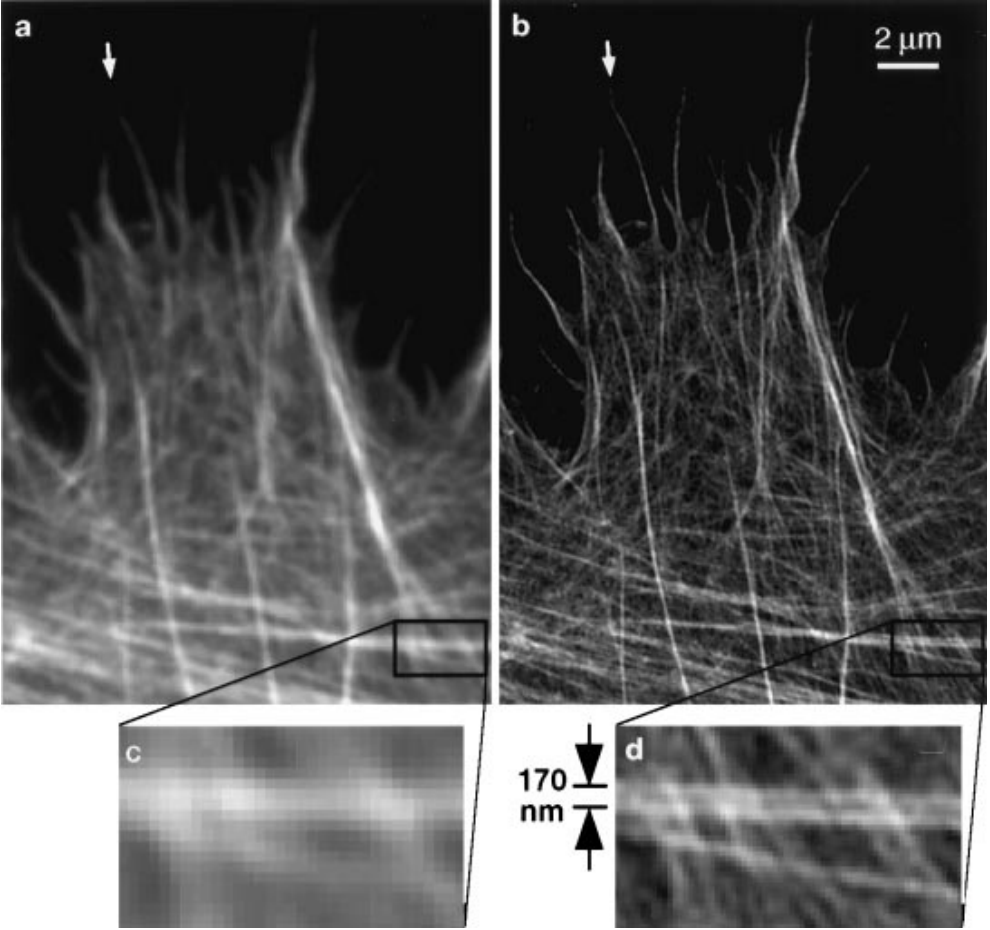
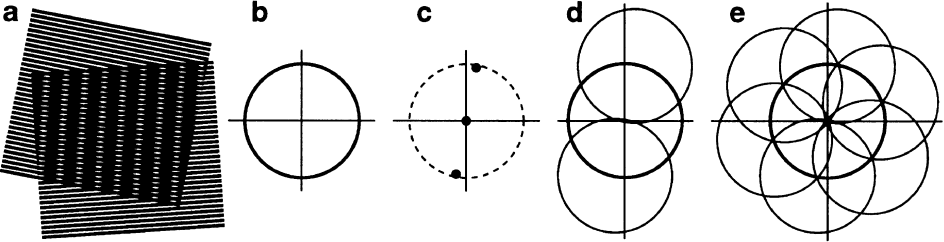
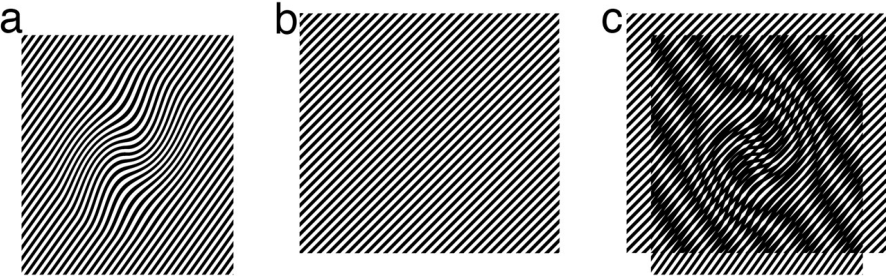


Imaging large field of view with high Resolution with LED light sources.

superresolution - STochastic Optical Reconstruction Microscopy - STORM

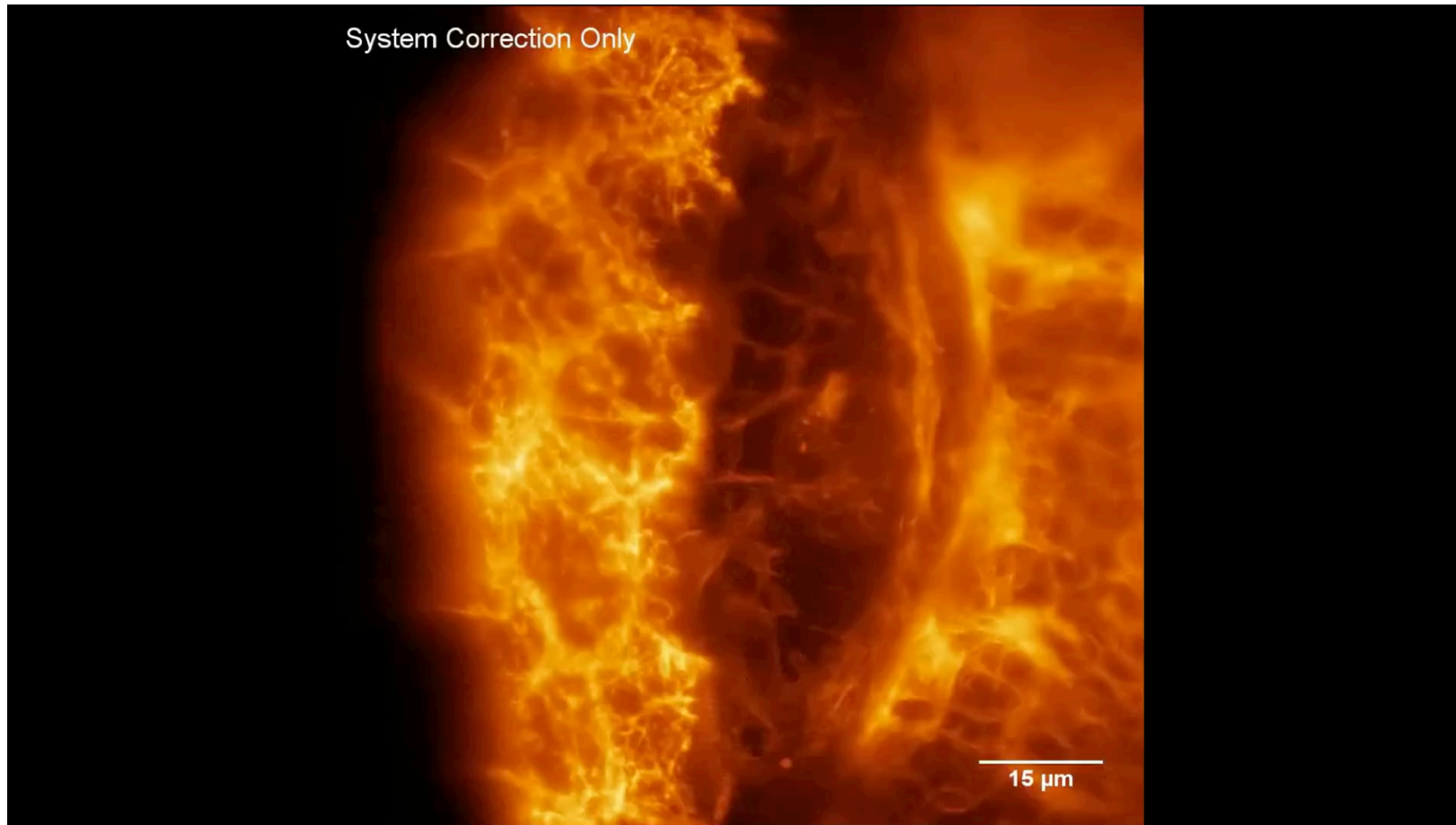


Structured Illumination Microscopy



Gustafsson, M. G. L. (2000). Surpassing the lateral resolution limit by a factor of two using structured illumination microscopy. *J Microsc.* 198(2), 82–87.

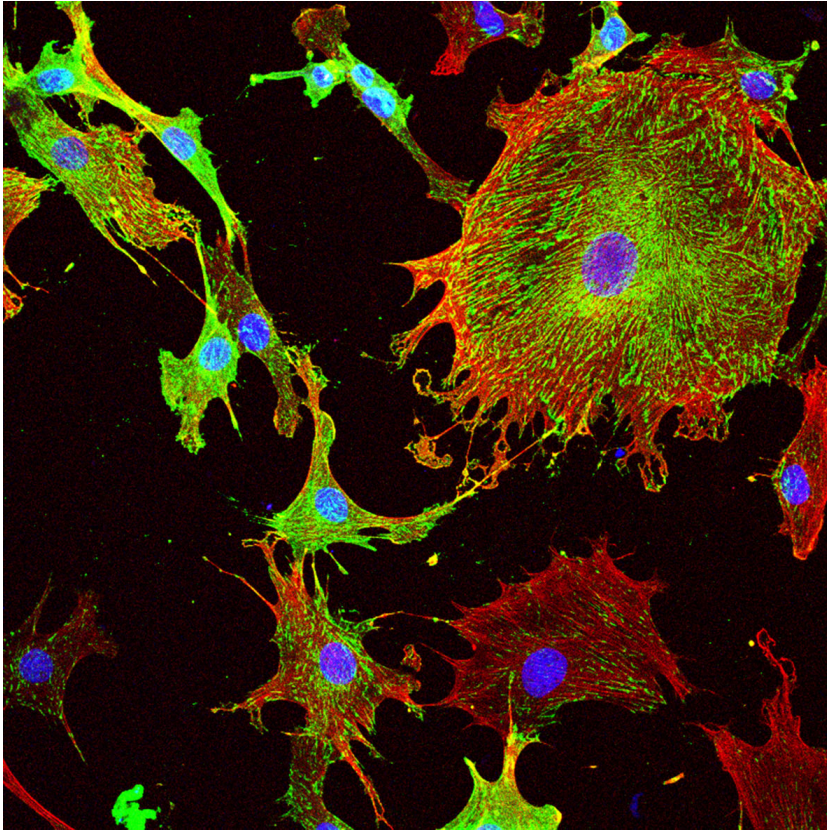
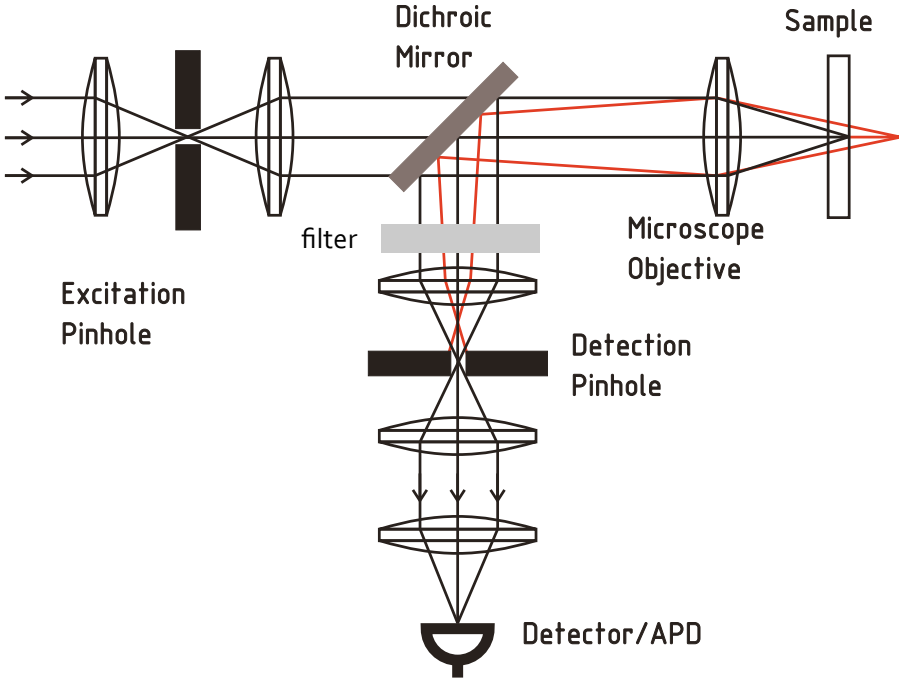
Just for the beauty



Immune cells within the perilymphatic space of the inner ear of transgenic zebrafish embryos

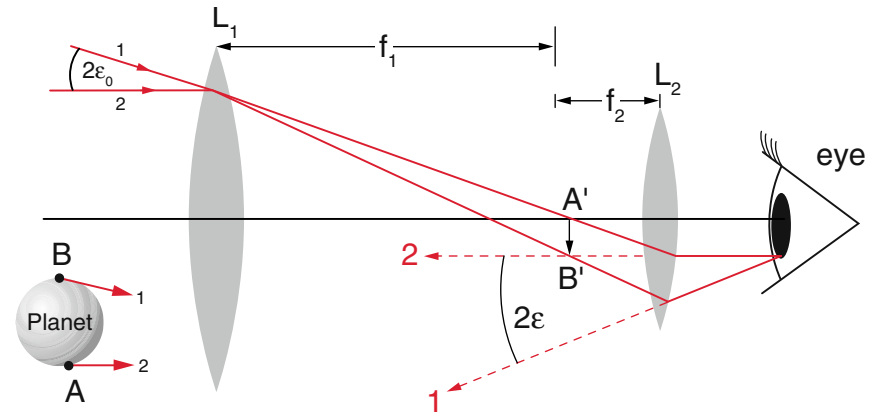
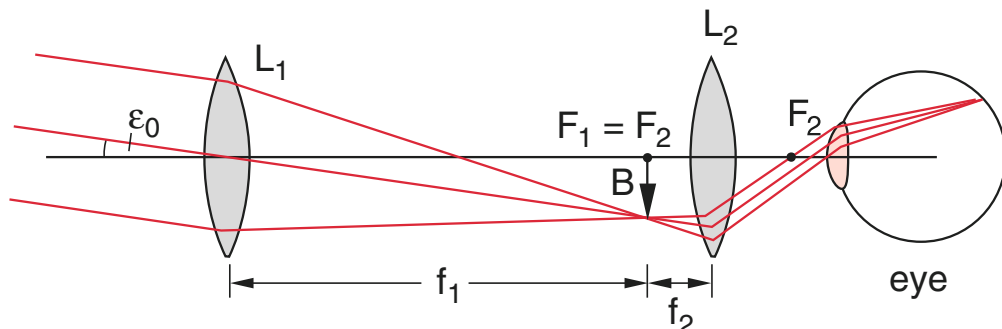
[1] T.-L. Liu, S. Upadhyayula, D. E. Milkie, V. Singh, K. Wang, I. A. Swinburne, K. R. Mosaliganti, Z. M. Collins, T. W. Hiscock, J. Shea, A. Q. Kohrman, T. N. Medwig, D. Dambournet, R. Forster, B. Cunliffe, Y. Ruan, H. Yashiro, S. Scholpp, E. M. Meyerowitz, D. Hockemeyer, D. G. Drubin, B. L. Martin, D. Q. Matus, M. Koyama, S. G. Megason, T. Kirchhausen, and E. Betzig, *Science* 360, eaaq1392 (2018).

Confocal Microscope



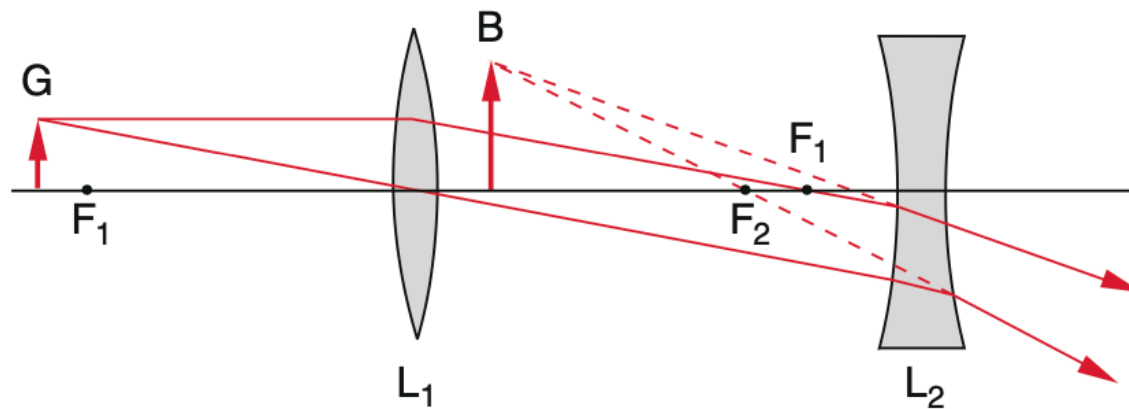
(c) Queen Mary University London

Astronomical Telescope (Kepler Telescope)



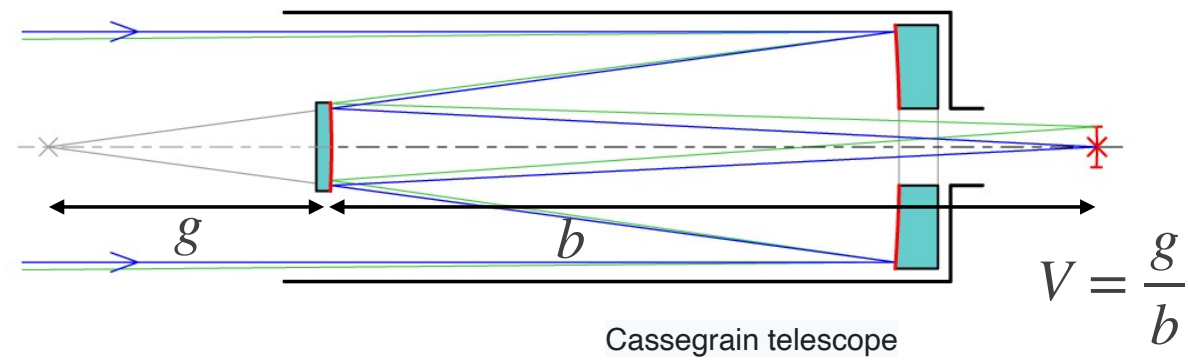
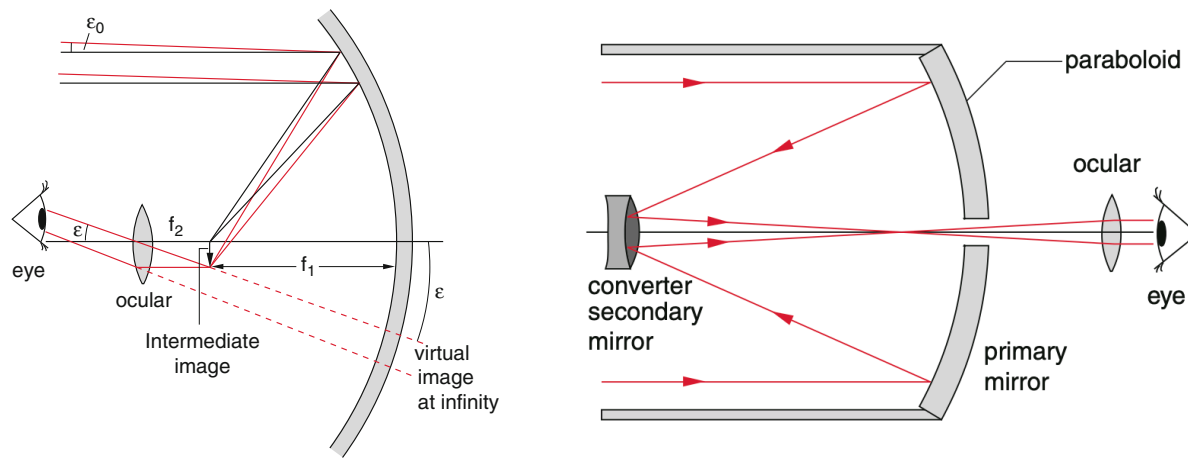
$$V = \frac{f_1}{f_2}$$

Terrestrial Telescope (Galilei Telescope)

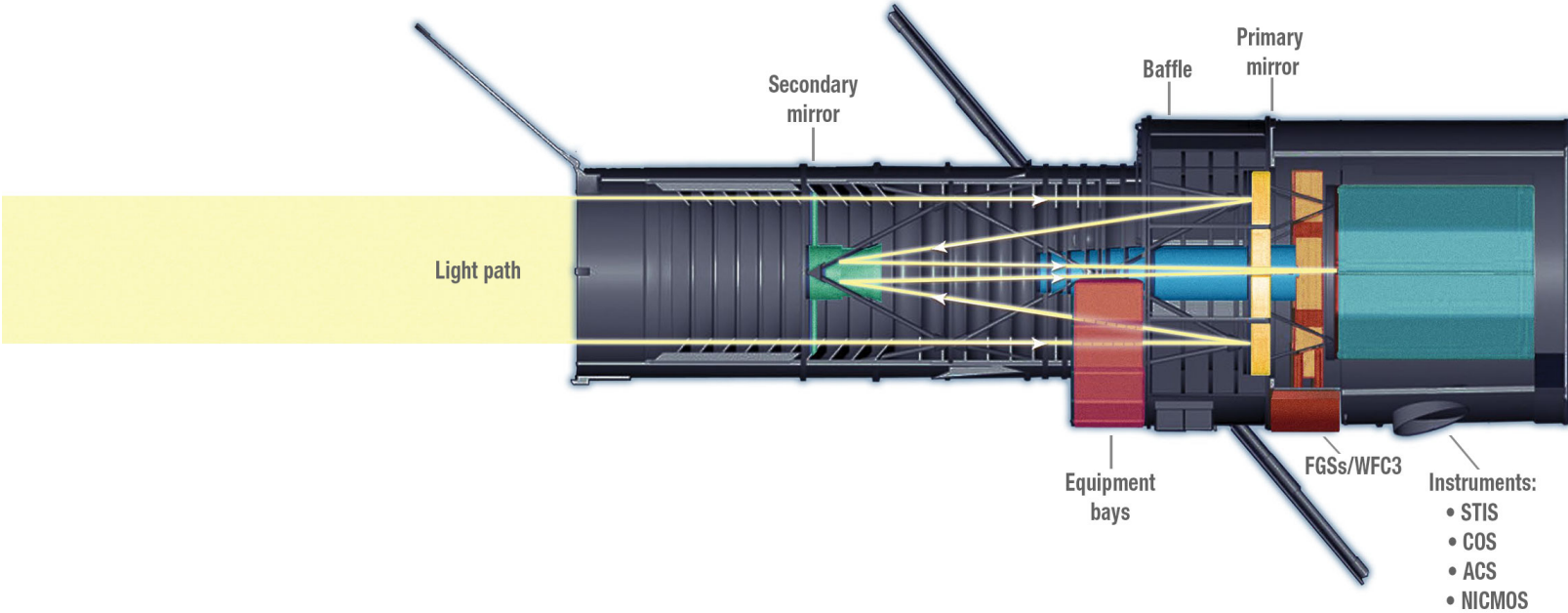
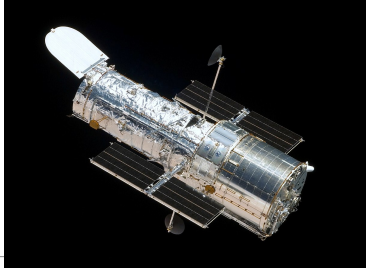


upright image

Reflecting Telescope



Hubble Space Telescope

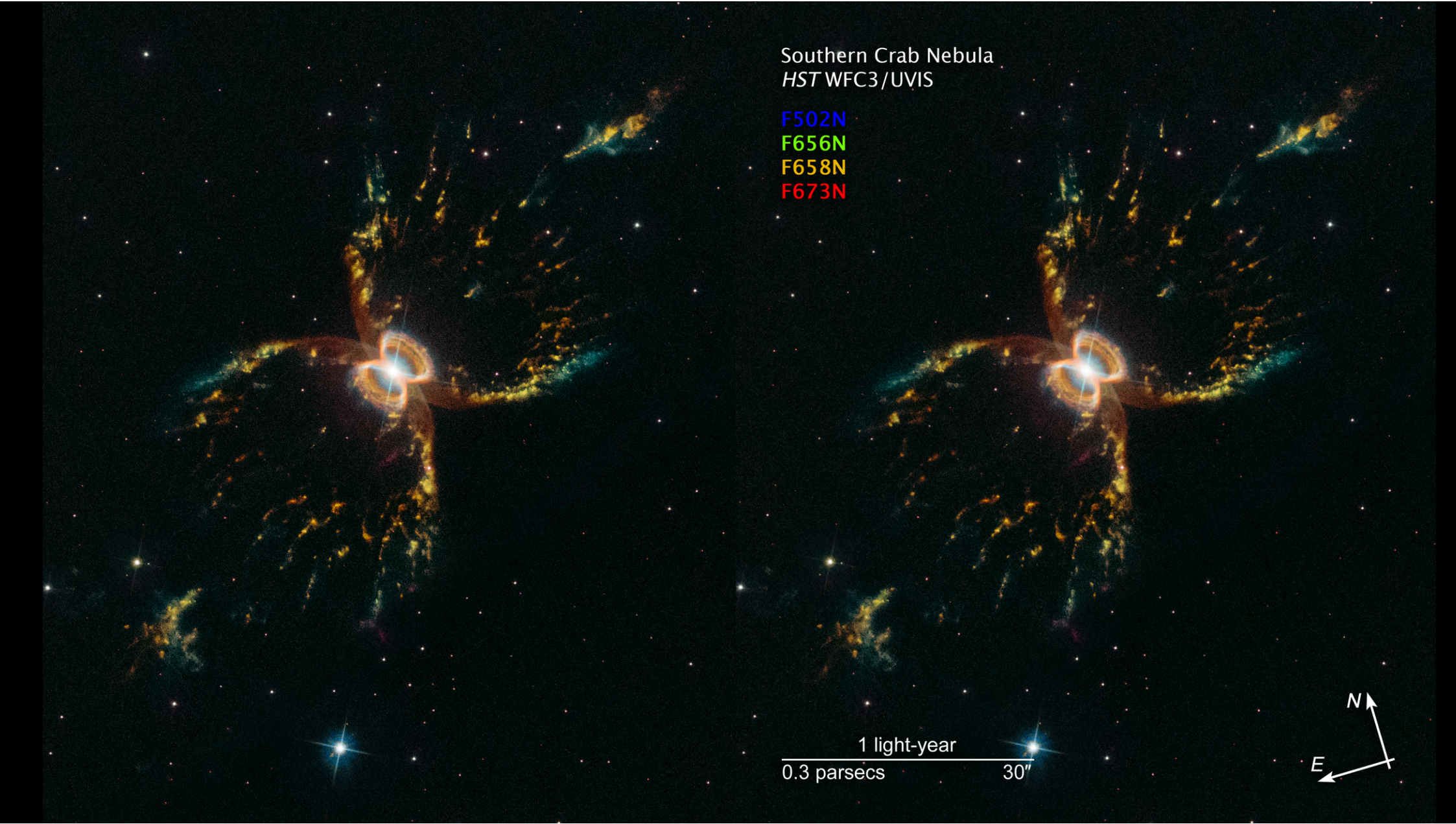


Cassegrain telescope

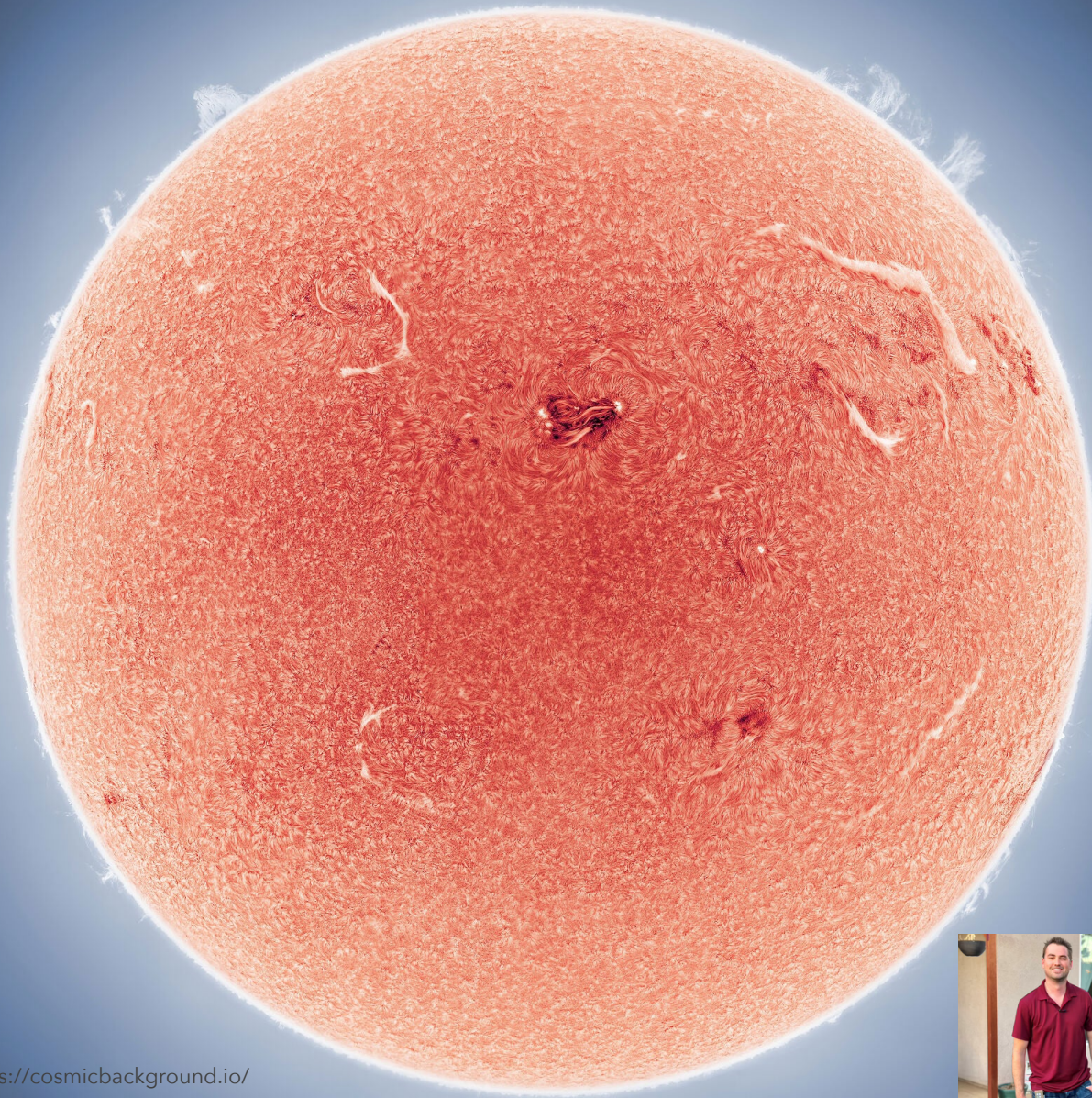
Southern Crab Nebula
HST WFC3/UVIS

- F502N
- F656N
- F658N
- F673N

1 light-year
0.3 parsecs 30"







<https://cosmicbackground.io/>