

Biophysics 210: Biological Light Microscopy
Kurt Thorn
Syllabus

Discussion section meets Tuesdays from 1-2:30pm in MH2100
Labs meet Thursday or Friday from 2-5pm (location varies)

Week 3: Fourier Optics and Cameras

Goals: Understand what kinds of cameras are commonly used in light microscopy. Know the difference between CCD, EMCCD, and sCMOS cameras. Understand the pros and cons of these cameras, and under what conditions you might choose one camera over another. Know how to choose a magnification to match a camera to your objective resolution (Nyquist sampling). Know how to read and interpret a camera data sheet.

Discussion Section: April 14th

Labs: April 16th and 17th

Lectures (watch before discussion section):

- [Fourier Space](#)
- [Abbe Diffraction](#) (You only need to watch the first 7 minutes, the lecture part, since we'll be doing the demo shown in lab)
- [Cameras and Detectors I: How Do They Work?](#)
- [Cameras and Detectors II: Specifications and Performance](#)

Additional Reading (optional):

- [Lambert and Waters: Assessing camera performance for quantitative microscopy. *Meth. Cell Biol.* **123**, p 35-53, 2014.](#)
- [MicroscopyU: Digital Imaging in Optical Microscopy](#)
- [James Pawley, More than you ever really wanted to know about charge-coupled devices](#) (appendix 3 of the Handbook of Confocal Microscopy)
- [Hamamatsu: The Living Image Technical Guides](#); In particular see their "[Changing the Game](#)" white paper.
- [Andor sCMOS Brochure and Technical Notes.](#)
- [Hamamatsu, Photomultiplier Tubes](#)
- James Janesick, Scientific Charge Coupled Devices
- James Janesick, Photon Transfer: $DN \rightarrow \lambda$

Discussion Section Topic: How to choose a camera and match it to your microscope. We'll work through various examples of different kinds of cameras and what kinds of experiments they would be most useful for.

Lab: Camera calibration and Fourier optics demo (Nikon Imaging Center)