

# 04 Photography 1: Framing, cameras, lenses

Tuesday, September 4, 2018 12:45 PM

- Admin:
- Admin
- Lighting **B.O.W.**
- Framing
- Cameras
- Lenses
  - Lens laws
  - Typical lenses
  - Focal lengths
  - Aperture, depth of field

- JH Bring to class:
- Closeup lenses
  - extension tubes
  - Iris
  - View camera

- Schedule; posted. Assignments every week.
- Office hours: Here after class, plus Tuesdays at 1. ECME 220, and by appointment.

Make CHOICES:

1. Flow phenomenon: Water boiling? Faucet dripping?
2. Visualization technique: Add dye? See light distorted by air/water surface?
3. Lighting (source of worst image problems). Match to vis technique.
4. Image acquisition: Still? Video? Stereo? Time lapse? High speed?
5. Post processing, final output. Edit, at least crop the image, consider contrast.

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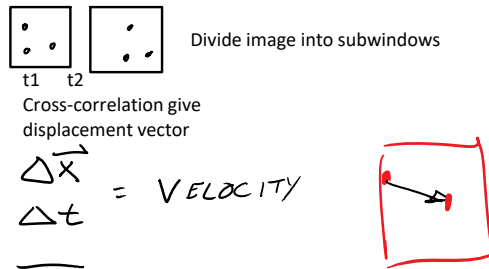
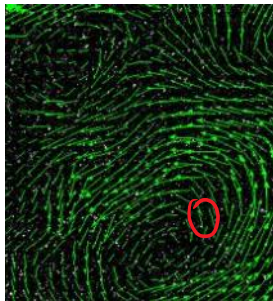
## 2: Visualization Techniques

Already talked about seeded boundary technique, and a little about refractive index. Here's the third main category: Particle Tracking.

Individual particles are seen. Can be qualitative or quantitative (Particle Image Velocimetry, PIV).

Two images made, close together in time

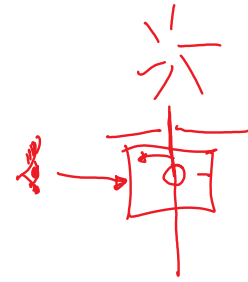
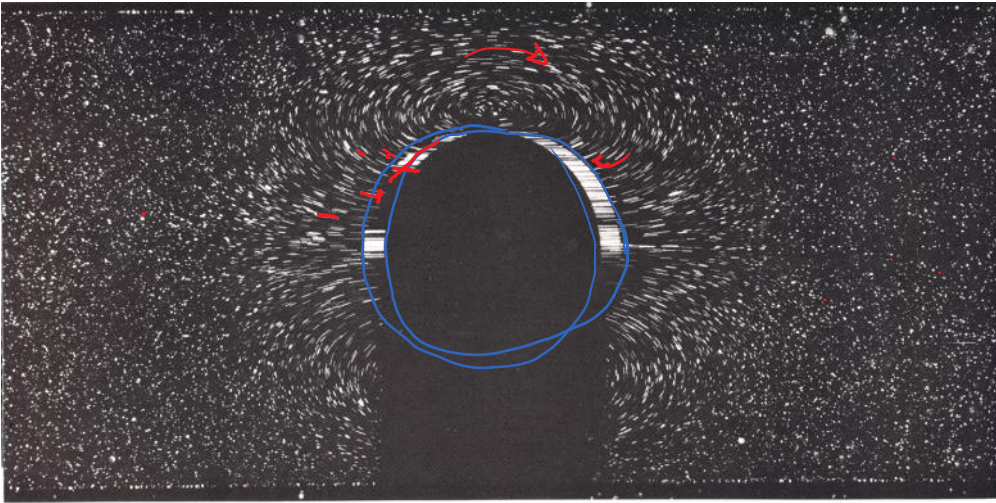
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Or, with motion blur, length of track can indicate speed.

From Van Dyke's Gallery of Fluid Motion



9. Sphere moving through a tube at  $R=0.10$ , absolute motion. In contrast to the photograph above, here the camera remains fixed with respect to the distant fluid. During the exposure the sphere has moved from left to right

less than a tenth of a diameter, to show the absolute motion of the fluid. At this small Reynolds number the flow pattern, shown by magnesium cuttings in oil, looks completely symmetric fore-and-aft. Coutanceau 1968

Small glitter particles: Pearl-Ex. Sold as iridescent pigment in art supply stores. McGuckin's or Guiry's, at Pearl and Folsom.  
 Pearl-Ex is mineral ( $\text{TiO}_2$  coated mica), not plastic, maybe safer for environment. Don't breathe it, or any dust, or get it in your eyes.

### OVERVIEW Part 3: Lighting

Your camera can only see light. Think about where it comes from and how (reflection, refraction, scattering) it gets into your lens.

For now, let's look at some examples from the Best of Web selections. More on light/matter interactions on next iteration.

### OVERVIEW Part 4: Image Acquisition.

We'll do this section in more depth than in the rest of our Overview.

Good digital photography references:  
 Thousands of books are out there. Do you have a preference? Do you want a book?  
 Choose something recent; technology is changing rapidly. We'll cover basics here to get you started.

#### Linked In Learning

- Lynda.com: online video tutorials for photography and video production  
 CU has a site license: [lynda.colorado.edu](http://lynda.colorado.edu)  
 Log in with identikkey



#### 4.1) Framing/Composition

- #1 rule of photography: Make The Subject Fill The Frame**  
 Yes, you can crop to achieve this, but image dimensions of less than 700 pixels won't be accepted.
- Know your scale.** Take an **extra** image with a ruler in it.  
 You'll need to specify your FOV = Field of View  
 i.e. "top to bottom was 10 cm"  
 Sometimes the image will supply the scale, such as the diameter of a jet.
- Work it.** Take many images, from varied POV = Points of View
  - Get close, pull back. Move around the sides.
  - Try a mirror to see the back.
  - Consider making a stereo image
  - Try video, a few seconds or minutes
  - Change the lighting.
  - Try time lapse (smartphone camera app is easy to use)
  - Consider the motion: Capture the whole track, and also zoom in on a particular moment/location
 Plan a second try. **Look at results at full resolution first**, not just on camera LCD. Takes time.



#### 4.2) Cameras: Roughly 4 common types, but technology is changing quickly

All have

- AE = Auto Exposure. Automatically sets shutter time, aperture, ISO (sensor sensitivity) according to varied programs
- AF = Auto Focus. May be contrast focus and/or phase detection technology. See <https://www.impeltier.com/2017/12/08/difference-phase-detection-contrast-detection-autofocus/>

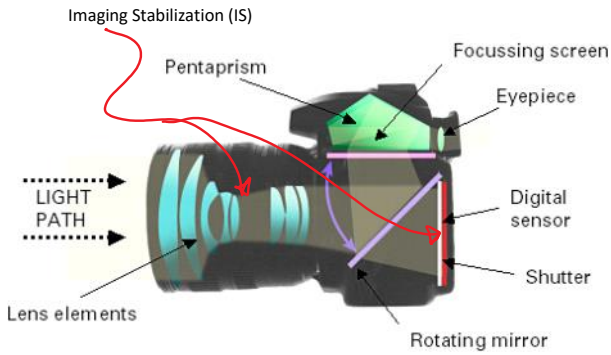
<u>DSLR</u>	<u>Mirrorless</u>	<u>Point and Shoot</u>	<u>Camcorder</u>	<u>Film</u>	<u>Phone camera only</u>
Digital Single Lens Reflex <b>27</b>	<u>Interchangeable lens</u> but no viewfinder, just LCD <b>3</b>	PHD Push Here Dummy. LCD viewer, fixed lens <b>3</b>		<b>3</b>	<b>6</b>

Who has what?

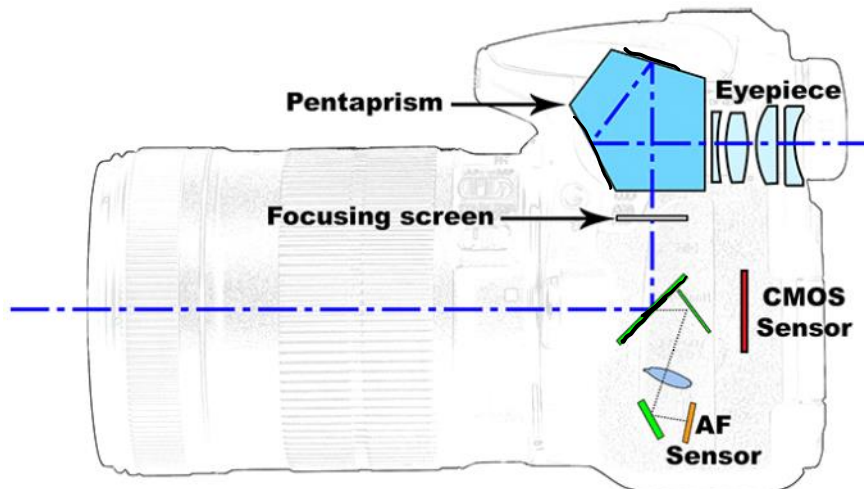
DSLR



[https://www.ephotozine.com/articles/nikon-d5-dslr-hands-on-preview-28654/images/highres-Nikon-D5-Internals-Cross-Section-1\\_1452055157.jpg](https://www.ephotozine.com/articles/nikon-d5-dslr-hands-on-preview-28654/images/highres-Nikon-D5-Internals-Cross-Section-1_1452055157.jpg)



<https://george12johnson12.files.wordpress.com/2015/03/slr02.jpg>



<https://2dhnizrxqv1awj231eodq1-wpengine.netdna-ssl.com/wp-content/uploads/2017/03/AFSensor.jpg>

Mirror flips up when shutter triggered = REFLEX.  
 For long exposures, lock mirror up to prevent vibration.  
 Use circular polarizers on lens front to get past partial mirrors into AF and AE sensors

**Mirrorless**

Same capabilities as DSLR, but no optical viewfinder; LCD display only. Image composition in varied lighting conditions can be difficult, harder for folks with glasses, less focus resolution. Maybe electronic shutter only?

**PHD:**

Small sensors; lower resolution even if mpx the same; diffraction limits approached?  
 Often no lens choices. Can still add close-up lens.  
 Composition is harder. LCD screens tough to use in sun, don't show fine focus (on low end cameras). Usually can't preview depth of field.  
 Much lighter, more portable.  
 Comparable performance at prosumer level.  
 Often excellent macro imaging due to small sensor and short focal length lens.

**Phone cameras**

Very small sensors, very short focal lengths but reasonable MPx. Can add lenses. Often dirty or damaged lens surface. Fixed aperture size, electronic shutters only. Difficult to specify exposure or focus; specialized apps may help. Unknown image processing.

**CAMCORDERS:**

primarily for video. Records to disk or solid state memory. Usually longer record time than still cameras. Built-in effects, maybe editing, quieter mechanisms, set white balance, better microphones

Camera technology is changing rapidly. Lines between designs are shifting. Superzooms, for example.

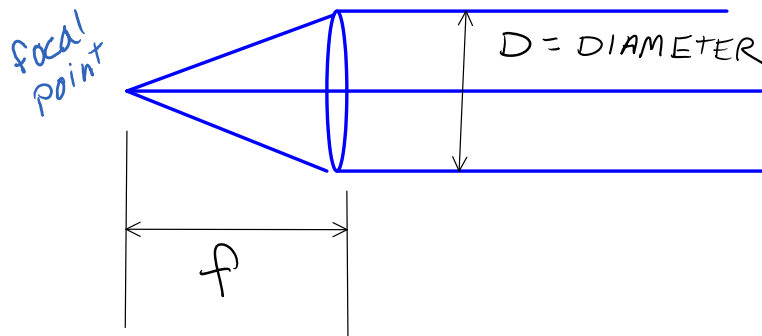
**3) LENSES**

Minute paper. What are the numbers on your lens? What do they mean?

18-140mm Focal length  $f$  Range = ZOOM  
 1:3.5-5.6 Aperture  $f$ : Diameter of light path  
 2.8-5.6 / 4.8-144 T\*

**Lenses are defined by FOCAL LENGTH and APERTURE and Diameter**

$f$  = focal length = distance from center of lens system to sensor when focused at infinity



$\odot$  Symbol for center of lens Or sensor location

$\emptyset$  Symbol for thread diameter

Here 2019 - Variable focal length = ZOOM lens.  
 Now is default. Non-zoom are called 'prime' lenses.

10 years ago, 35 mm film cameras were standard, and the standard lens was 50 mm.  $f > 50$  mm = telephoto

$f = 18 - 55$   
= focal length range

$f < 50$  mm = wide angle

$f \# 3.5 = \text{aperture} = f/D$

$f/D = 3.5 - 5.6$

= range of maximum aperture

Aperture defined as  $f/D = f/\# = f \text{ number} = f\#$   
INVERSELY related to diameter.  
Nondimensional. More about aperture later.