05 Photography 1: Framing, cameras, lenses

Wednesday, September 2, 2020   12:45 PM

Today:
- Admin
- Finish techniques overview
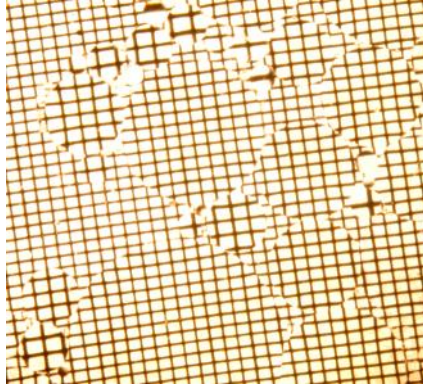- Lighting
- Workflow
- Cameras

Too much

Admin

- For ME Entrance window competition, 6:1 wide to tall aspect ratio, good B/W.
- Monday: Download and install Darktable for image processing. https://www.darktable.org/ . Virtual light table for organizing your still images and darkroom for modifying them. Open source, please make a donation
- Next Weds:
  "MiniTool MovieMaker | Easy-to-Use Free MovieMaker Software." https://moviemaker.minitool.com/. Good for beginners, free version limited to < 2 minutes
- But Davinci Resolve is much more powerful, professional, but has steeper learning curve. Free for individuals.
- Blender, open source, powerful, written documentation terrible, but good video tutorials.
- Office hours: Here after class and by appointment. Quicker answers on Slack. Plus, other students may have the same questions, or know the answer.
- Three minutes in breakout. Show your cameras. Talk about your BOW, Get Wet or Clouds 1 progress

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Overview:
Make CHOICES:
1. Flow phenomenon: Water boiling? Faucet dripping?
2. Visualization technique: Add dye? See light distorted by air/water surface?
   1) Boundary
   2) Refractive index
   3) Rheoscopic
   4) Particle tracking
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. We'll skip ahead to this Monday and Weds.
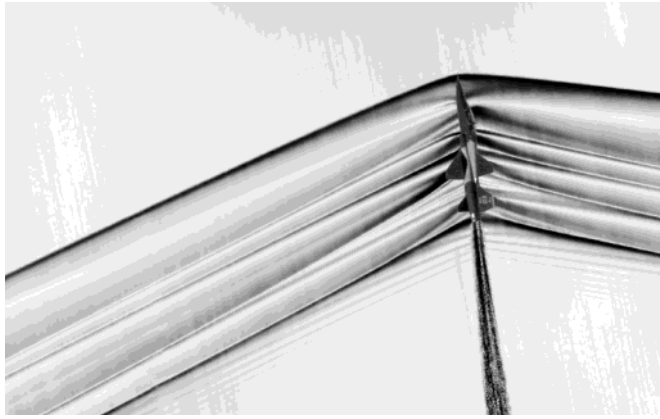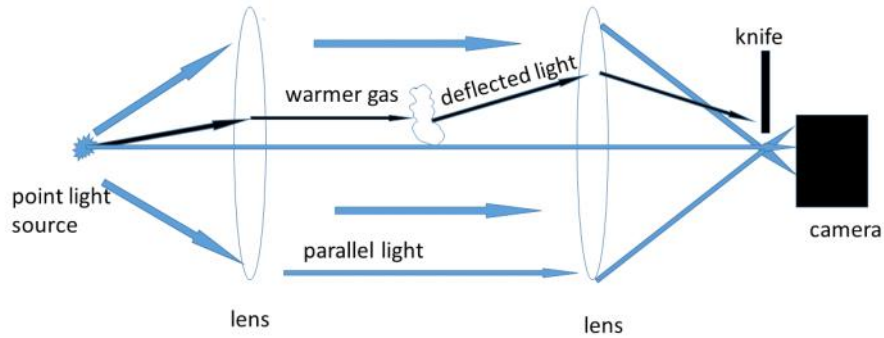

Finish Refractive Index

Liquid lenses formed by oil floating on water distort the grid beneath.

Tracy Eliasson
Get Wet 07

OIL
H₂O
Graph paper

Acoustic Shockwaves Exiting A Trumpet Bell

BOS=Background Oriented Schlieren
Uses sky light, and distance to get parallel light
Subtracts out background (earth's surface in this case, view is looking down) and renders distortions as b/w
Aircraft: T-38 Talon

http://www.nasa.gov/centers/armstrong/features/shock_and_awesome.html

Rheoscopic Fluids
An in-between technique. Mostly qualitative
Low contrast, doesn't often show physi

Rheoscopic means 'current showing'
http://www.stevespanglerscience.com/pearl-swirl-rheoscopic-concentrate.html
'Pearl Swirl' $5/gallon
Shiny opaque or translucent particles, crystal flakes, ~10 µm size, aligns with shear gradient.
Used in soaps, shampoos
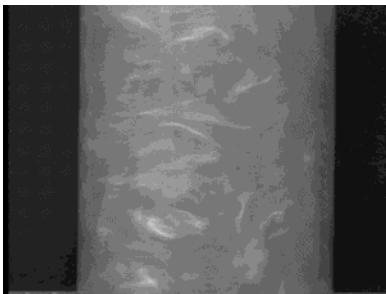Kalliroscope used to be the only available type, made from fish scales.

Image credit http://buphy.bu.edu/~duffy/thermo/4B20_77.html

Convection Cell "Sea Breeze" Visualization
https://www.youtube.com/watch?v=22zVmRYOW10

Illustrates difference between boundary method and rheoscopic

Easy to make from shaving cream: stearic acid crystals
Borrero-Echeverry, Daniel, Christopher J. Crowley, and Tyler P. Riddick. "Rheoscopic Fluids in a Post-Kalliroscope World." *Physics of Fluids*
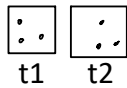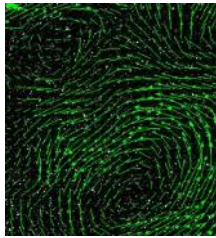
Streaming birefringence
'Blackstock fluid' has 2 indices of refraction
Suspension of microscale mica flakes.

http://www.laminarsciences.com/

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c. Particle tracking techniques

Individual particles are seen. Can be qualitative or quantitative (Particle Image Velocimetry, PIV).
Two images made, close together in time
http://fiji.sc/wiki/index.php/File:Surface_wave.gif

Divide image into subwindows

Cross-correlation gives
displacement vector

$$\frac{\overrightarrow{\Delta x}}{\Delta t} = VELOCITY$$

Pasted from <http://www.google.com/images?q=particle+image+velocimetry&hl=en&client=firefox-a&hs=NUI&rls=org.mozilla:en-US:official&prmd=ivnsb&source=lnms&tbs=isch:1&ei=9CY3TcyNH8L7lweQ2uSMAw&sa=X&oi=mode_link&ct=mode&cd=2&ved=0CBAQ_AUoAQ&biw=993&bih=412>

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

From Van Dyke's Album of Fluid Motion
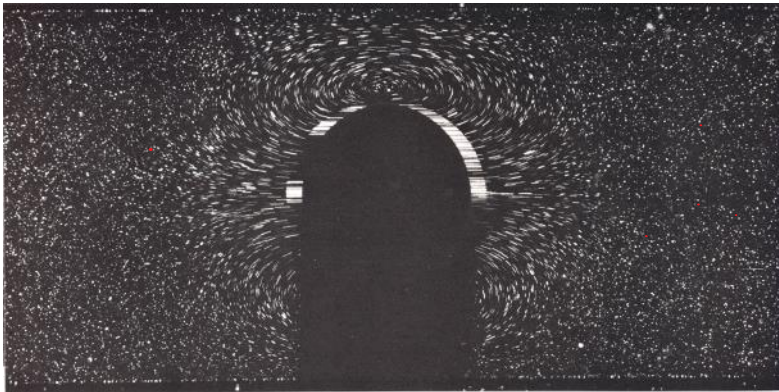
9. **Sphere moving through a tube at R=0.10, absolute motion.** In contrast to the photograph above, here the camera remains fixed with respect to the distant fluid. During the exposure the sphere has moved from left to right less than a tenth of a diameter, to show the absolute motion of the fluid. At this small Reynolds number the flow pattern, shown by magnesium cuttings in oil, looks completely symmetric fore-and-aft. *Coutanceau 1968*

$$Re = \frac{\rho U d}{\mu}$$

Dynamic or absolute viscosity

$$\nu = \frac{\mu}{\rho}$$

Kinematic viscosity. Scaled by density.

$$Re = \frac{U d}{\nu} = \frac{momentum}{viscous}$$

Re< 2000 or so flow is LAMINAR, smooth, in layers. Viscosity is important
Re> 2000 or so flow is TURBULENT, full of eddies, much mixing.
Momentum is important, viscosity not so much.
https://www.omnicalculator.com/physics/reynolds-number
Makes units, fluid properties easy.
Everybody should do this for their reports.

Good particles in water:
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 (TiO2 coated mica), not plastic, maybe safer for environment. Don't breathe it, or any dust, or get it in your eyes.

Streamline