07. TeamsFacilities

Wednesday, September 11, 2019 6:20 PM

Today:

Team member Expectations
Critique overview (07a)
Facilities and Equipment

Bring to class:
Zeroblasters
Small fog machine
Ultrasonic humidifier
Desk toys

Admin stuff:

- Please sit with your team, so you can discuss possibilities as they come up today
- Team First project plan and selfies due this Monday 9/12. Short statement of what you are planning to do. Each person, online in Canvas.
- Team First image due Weds 9/21. Same upload and posting requirements as Get Wet.
- Example Reports: Read the guidelines. Good reports: 2012 team First Ryan Kelley, Nicholas Travers
- Chem Stores: on campus source for glassware, chemicals, lab supplies (cash OK): https://www.colorado.edu/chemistry/research/facilities/chemstores-chemstores-east
-
- Optics cleaning tips: http://www.newport.com/How-to-Clean-Optics/141176/1033/content.aspx for lab optics
- https://www.adorama.com/alc/faq-how-to-clean-camera-lenses for camera lenses
  - Cleaning fluids: OK to buy a commercial variety, or try distilled water first, then isopropyl (rubbing) alcohol, then ethyl alcohol (lab grade), then acetone as a last resort.

denatured

Team Expectations

Expectations For Teams
Flow Visualization

Hard to work alone?
1 yes 35%
2 Not much 42%
3 prefer 23%

Reasons for putting you on teams:

1. So that you can attempt to image more complex flow phenomena. If the work of developing a setup is spread out among you, then you can try a challenging experiment.
2. So that you can attempt more challenging imaging techniques. The teams were chosen to spread out photographic and fluids expertise and equipment amongst the teams.
3. To have partners to bounce ideas off of. This makes ideas multiply.
4. To get informal feedback on your work.
5. To interact with students from different backgrounds.

Thus, working on a team is STRONGLY EXPECTED, but not strictly required for the team assignments. You are not required to work only with your team, but you are expected to make significant effort to be available to help them with their images and ideas. You do not all have to use the same equipment. Do plan to spend at least an hour or two to help **each** of your teammates, and recognize that you can plan on having 4 to 8 person-hours at your disposal for your project. Plan multiple meetings. If you find you are not available for specific sessions, figure out how to make it up to your team.

I hope you will take advantage of the benefits of working in teams and of the opportunity to broaden your network. Strong recommendation: don't work only with your friends. Bad for you professionally.

Following from this, here are the expectations for the deliverables on the team assignments:

Each student is expected to turn in a unique image or video that they had primary artistic and scientific responsibility for. You must give credit appropriately in your report, by explicitly naming the teammates that contributed, and what they did.

Each image/vid must be accompanied by a report. If several images come out of the same setup, you can copy descriptions of the apparatus, and the basic physics. If appropriate, give credit to report section authors. Be sure to describe the details relevant to your particular image.

Equipment and Facilities

Flow Visualization Equipment and Facilities
09/06/22
MCEN 4151-5151/ ATLS 4151/ Film 4200/Arts 5200
Flow Visualization: The Physics and Art of Fluid Flow

Here is a list of flow facilities; equipment for checkout is listed below. Unless otherwise specified, most of this stuff is in my lab ECME 1B64, and I will check it out to you.

ITLL equipment:
Launchpoint (upstairs, north end) and The Project Depot (1B60) have all kinds of free stuff to make small fluids apparatuses from.

Idea Forge: The Idea Forge (east end of Fleming) also has a huge assortment of free parts for DIY setups; glassware, plexi, pumps, plumbing, fans etc..

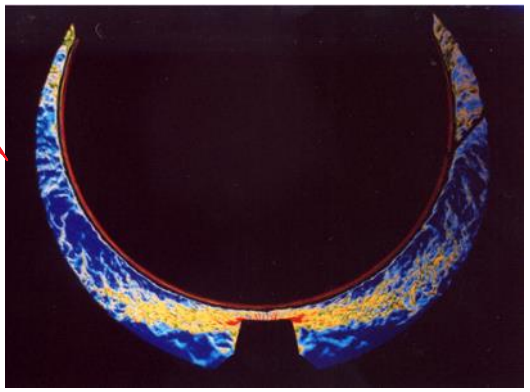
FLOW FACILITIES: AIR

Facility	Lighting	Visualization	Phenomena	Access
Vortex ring generators; zeroblaster, or timed generator (needs a little work).	Try projector for light sheet, or strobe	Stage fog	Vortex rings, symmetric and asymmetric	JH Lab
Laser sheet/fog Desk toy	Built in rotating mirror and green laser pointer	Built-in stage fog generator	Turbulent jet cross section and room air turbulence/mixing	JH Lab
Medical nebulizer, ultrasonic humidifier	Strobe for volume vis	Dry ice vapor[1] humidifiers, steaming pots, medical nebulizers (<$5)[2] Fog generators	Jet flows, positive buoyancy convective flow	JH has nebulizers, humidifier, fog machines
2 small (4 inch diameter) schlieren	EG&G strobe, provided. Maybe works.	Schlieren: Light bent by η gradients	Convective flows from warm/hot	

[1] Dry ice is solid carbon dioxide. Do not seal into a container, let it breathe. Handle with extreme care; it can freeze flesh and displace breathable air. Cover with hot water for best effect, otherwise a water ice shell will form.
[2] Do not nebulize oils (i.e. canola) without use of a proper respirator or aerosol filter mask: oil coated lungs define pneumonia and asphyxiation.

Surprisingly difficult to capture.

Brynne Sutton, Emrys Hall, Thomas King, Bethany Rotherham FV2003



Colleen Stroud FV 2004

systems for home checkout.	Bright single LED headlight works well too.	Could do stereo with 2 small systems	objects: hands, candles, hair dryers (turbulent jet). You may need time to make your own color stops. Can be used in water too.	
Reuben's Tube	Flame	Flame length represents pressure.	Standing wave resonance in a pipe, excited by a loudspeaker on the end.	?

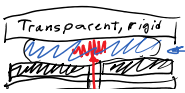
FLOW FACILITIES: LIQUIDS

Facility	Lighting	Visualization	Phenomena	Access
Flume	LED panel	Surface flow or food dye injection. Must change water after	Open channel flow. Flow around obstacles	ITLL. Reservation required.
Small water tunnel for checkout; 3' long, 2'deep	Includes water pump for circulation	Bubbles Dye, rheoscopic fluid, paint, anything safe for drains	Designed for object wakes	
Large Fish Tank. (50 gal)	Strobe or work lights	Food coloring. Be sure to bleach water clean afterwards	Short jets, vortex rings, boundary layers	
Small (10 gal) Fish Tanks, larger fish tank, pumps available too.	Strobe, laser sheets	Food coloring, alumina powder, cornstarch particles; anything you are willing to put down your own drain.	Short jets, vortex rings, boundary layers Steady vertical vortex (from stirring machine) Small ring generators available.	
Hele-Shaw cell	Work light or bounced strobe	Food coloring of detergent, corn syrup, water, etc	Saffman-Taylor instability	

Tanner Ladtkow, Tim Read FV 2006

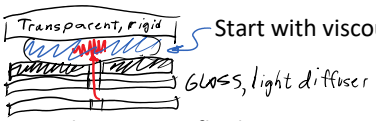
Melissa Talmage,
Nigel Gorbold, Lok Kin lee, Christopher McCray, Taylor Simonson FV2006

Hele-Shaw cell



Start with viscous fluid

Hele-Shaw cell
Taylor-Saffman instability



Start with viscous fluid

Inject less viscous fluid

http://www.flowvis.org/category/flow-categories/saffman-taylor-instability/

Glitter Tank 6 foot X 3 inch black PVC half tubes	LED or other worklights	Glitter (Pearl-Ex), Pearl Swirl or pearlescent shampoo	Wake and wave phenomena	JH. Would benefit from small recirc pump.
Fish Tank JH lab only (voltage source limitation)	Strobe, LED or work lights	**Hydrogen Bubble** apparatus	Any motion in salted water	JH. Extra training and work required
Liquid Desk Toys: lava lamp, vortex lamp, drip timers, sparkly fluid in balls, etc.		Built in	Various, including low-order turbulence, wakes, droplet motion	JH office. An assortment of dynamic desk toys that have fluid motion.
Blackstock Rheoscopic Fluid cell	Has polarized light setup	Streaming birefringence	Cylinder wake	Prof. Hertzberg. Also have extra fluid available, but apparatus must be very clean; no salts.
Ferrofluid	Normal studio lighting	Move it with magnets. You need to supply magnets.	Magnetic field lines	JH. Bring small container. Impossible to clean up spills. Will stain anything. Nontoxic, though.
Glycerin				JH lab. Mix with soap solutions to extend soap film life
Droplet Splash System. Has excellent documentation	Has dedicated Nikon camera and strobes. Requires Android phone for synch app	Reflection and refraction of fluids	Worthington jets, crown splashes	JH

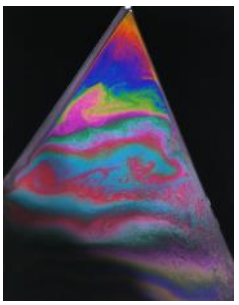
GOT TO HATE

Ferrofluid Climbs
http://vimeo.com/55136676
David Oakley, Peter Davis, Kerylyn Lay, Jakob Anderegg, Brayden Hass.
2012
Pasted from
<https://vimeo.com/home/myvideos/page:2/sort:date/format:video>

Ferrofluid Flies Up
http://vimeo.com/55075720
Brayden Hass, Jakob Anderegg, Peter Davis, Kerylyn Lay, David Oakley
2012
Pasted from
<https://vimeo.com/home/myvideos/page:2/sort:date/format:video>

Add watercolors:
http://fabianoefner.com/?portfolio=millefiori

http://www.youtube.com/watch?v=iGySs9bJbwU&feature=youtube_gdata_player



Katina Butler, Kerstin Lieff, Adrien Robert, Chris Wilke, FV 2004 team1

http://www.flowvis.org/2016/09/11/worthington-jet-of-first-drop-collides-with-second-drop/

Small Equipment Checkout

Equipment	Location	Notes
Stage fog generator (cooled)	JH	Fog is nontoxic water-based glycol solution. Can leave residue, and may trigger smoke alarms in high concentrations.
Stage fog generator, (small)	JH	Buy at Lowe's or Target in late September , $30 Is basically a vape system but no human required.
Zero Blaster ring generator and fog fluid	JH	
Ultrasonic humidifier	JH	
Glass sheets,(3), tempered. 28" x 10 to 17"	**CAMERAS and LENSES**	
Vision Research VR Micro C110 **High** speed video.	$$ Check out from ITLL Project Depo.	Mo.Woods@colorado.edu.
Olympus I-Speed high speed video system	ME Idea Forge. See Shirley Chessman	Training required. Up to 30,000 fps, but is low resolution, and low sensitivity; needs lots of light.
Canon extension tubes (for cheap lenses, no electronic pass thru)	JH	
Nikon extension tubes	JH	
Nikon 24 mm wide angle lens	JH	
Nikon 50 mm lens	JH	
Nikon macro lens 102 mm	JH	Manual only
Closeup Lenses: +1, 2, 4 in 58 mm dia, +2,+3 in 72 mm dia.	JH	
Stereo cameras (film) and slide bar	JH	
FLIR Infrared thermal imaging camera. For iPhones only		

	LIGHTING	
Dimmable Bi-color 660 LED Video Light (continuous) with Barndoor and 6.5 feet Light Stand,	ITLL has one, JH has two	
Godox VING V860IIN TTL Li-Ion **Flash with** X1T-C TTL **Trigger Kit** for Nikon	JH	Good for remote and multiple triggers
Godox VING V860IIC TTL Li-Ion Flash with X1T-C TTL Trigger Kit for Canon Cameras	JH	Good for remote and multiple triggers
Yongnuo YN560-IV Speedlite Flash with Manual and Slave Control"	JH	Can be triggered by flash on your camera
Umbrella reflectors	JH	2 on stands, one short/table mount. Comes with weak CFL lights
24" (60cm) 5-in-1 Disc Light Reflector with Bag -	JH	Translucent, Silver, Gold, White and Black
Sunpak Auto 383 Flash (strobe) unit & 25' pc cable	JH	
CW 1 watt blue LED laser	JH	Serious safety training required
Party strobe	JH	
500 W work lights, several sets	ITLL, JH	
Small LED worklight pair	JH	
North Star video lights (2), cooled	Idea Forge	
	MISC	
Gretag-Macbeth/X-Rite Eye-1 Spectrophotometer	See Prof. Hertzberg	For color calibration of monitors, cameras, printers and projectors.
Large black backdrop (8 foot square), integral stand	Idea Forge	Lots of fun to fold back up.
Small white table-top tent, ~2 ft^3	Idea Forge	Provides diffuse white light and control of reflections
black velvet	JH	Small pieces
Assorted tripods	JH	
LP Turntable	JH	For study of rotating flows

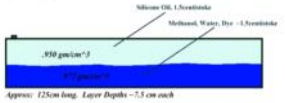
ATOC Equipment

Scott Kittelman <alan.kittelman@colorado.edu>
Department of Atmospheric and Oceanic Sciences
CB-311
303-492-4248 (lab phone number)

Scott has a wide range of equipment available, and he is happy to work with groups in his lab. He is busy, so scheduling in advance is required.

1) Karman vortices – Kalliroscope visualization in a large circular tank

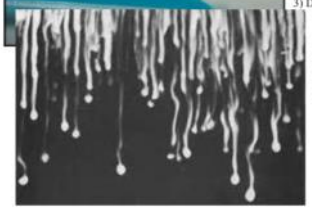
2) Two layer tank with two immiscible fluids



Example of a gravity current with two layer tank

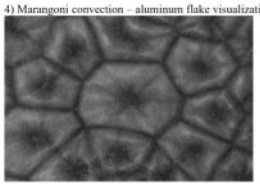
Kelvin-Helmholz instability in a 6' clear acrylic tank –two or three layer – dye visualization

3) Double diffusive convection "Salt fingers"

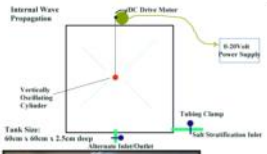


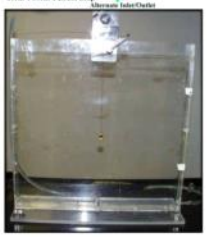
Salinity and temperature diffusion rate differences result in vertical mixing within a statically stable fluid.

4) Marangoni convection – aluminum flake visualization, timelapse video best

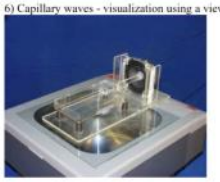


5) Internal gravity waves in a continuously stratified fluid- shadowgraph or Schlieren visualization

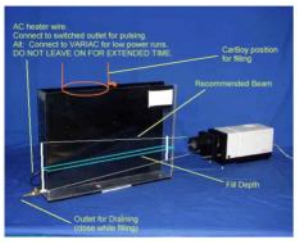




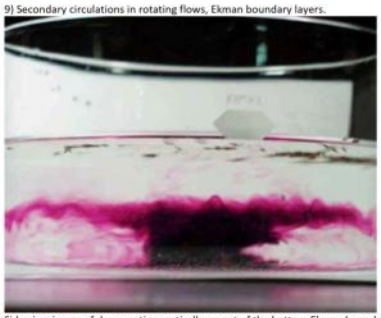
6) Capillary waves - visualization using a view graph projector.



7) Surface gravity waves with a shallow water ripple shadowgraph imagery.
Can visualize wave:
interference
reflection
refraction
dispersion group and phase velocity plane and circular waves
Doppler effect
8) Thermal convection – aluminum flake visualization of convection over a heating pad in a 6" layer of silicone oil



9) Secondary circulations in rotating flows, Ekman boundary layers.



Side view image of dye erupting vertically up out of the bottom Ekman boundary layer.