13.TeamsFacilities

Tuesday, February 15, 2011 5:20 PM

Today:

Schedule	Bring to class:
Team member behaviors	Zeroblasters
Facilities and Equipment	Small fog machine
	Ultrasonic humidifier
	Desk toys

Admin stuff:

- Please sit with your team, so you can discuss possibilities as they come up today
- Plan for Team First projects due Wednesday Oct 5
- Team First image due Monday Oct 17.
- Schedule
- 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): http://chem.colorado.edu/purchasing/index.php/chemstores/2-uncategorised/21-chemstores-west
- Optics cleaning tips: http://www.newport.com/How-to-Clean-Optics/141176/1033/content.aspx
  - 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.

Team Behaviors

This American Life #370 Ruining It for the Rest of Us.
Bad team behaviors: The Jerk, The Slacker, The Depressive
The cure: solicit input from everyone.

http://www.thisamericanlife.org/sites/all/play_music/play_full.php?play=370

Expectations For Teams
Flow Visualization

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
09/27/16
MCEN 4151-5151/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.
Make a reservation with Christine.Buckler@colorado.edu to use the big facilities in the ITLL (flume, wind tunnel, sink space room). To check out the smaller equipment in the ITLL, including stuff stored in the Media Shack, see Kai Amey (ameyexc@Colorado.edu). His office is the checkout office on the 2B level of the ITLL. If he is not there, pick up the checkout phone on the south facing wall near the south stairs of either lab level; an equipment checkout person should be able to help you. Shirley Chessman in the Idea Forge (east end of Fleming) has a huge assortment of free parts for DIY setups; glassware, plexi, pumps, plumbing, fans etc.. Kai Amey in ITLL has a stash of miscellaneous free stuff in the Project Depot room.

Both ITLL and Idea Forge have space for temporary setups. For official access, everybody must take a short free orientation tour (once in your life) to learn what is available. Idea Forge tours are MTR @ 4pm, lower east entrance (Fleming building). ITLL tours M-F 5:15, lobby, bring Buffcard.

* Means equipment is currently in Hertzberg's lab ECME 1B64, but after first use will be in ITLL for checkout.

FLOW FACILITIES: AIR

Facility	Lighting	Visualization	Phenomena	Access
Vortex ring generators; zeroblaster, or timed generator. Use in the ITLL sink space (can be made dark), or checkout for home use.	Try projector for light sheet, or strobe	Stage fog	Vortex rings, symmetric and asymmetric	*Check out fog generators and timed vortex generator from ITLL; in MediaShack Check out zero blasters and projector from JH
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	*

Some stuff is in my lab, not in ITLL yet.

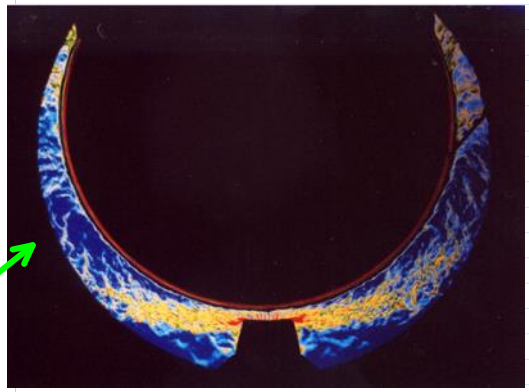
Surprisingly difficult to capture.

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

Misc air flows	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
Color Schlieren. Large system for ECME 1B64 (JH lab) only. 1 small systems for home checkout.	EG&G strobe, provided. Maybe works. Bright single LED headlight works well too.	Schlieren: Light bent by η gradients Could do stereo with 2 small systems	Convective flows from warm/hot objects: hands, candles, hair dryers (turbulent jet). You may need time to make your own color stops. Can be used in water too.	See Prof. Hertzberg, last two projects only.
Reuben's Tube	Flame	Flame length represents pressure.	Standing wave resonance in a pipe, excited by a loudspeaker on the end.	JH. You'll need to provide a regulated propane supply, and follow combustion guidelines.
Lycopodium powder		Fine tracer dust, good for air or water surface	Cymatics; vibration modes	JH. Flammable; requires caution.

https://vimeo.com/74130357
By Susie Sie

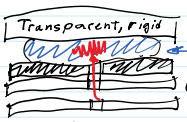
[1] Dry ice is solid carbon dioxide. Do not seal into a container, let it breathe. Handle with extreme care; it can freeze flesh and displace breathable air. Cover with hot water for best effect, otherwise a water ice shell will form.
[2] Medical nebulizers require a small compressed air source. Do not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



Colleen Stroud FV 2004

Tanner Ladtkow, Tim Read
FV 2006

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



Start with viscous fluid

Inject less viscous fluid

Hele-Shaw cell
Taylor-Saffman instability

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

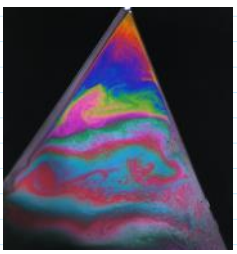
Needs glass top sheet

GI Taylor film includes reversible flow
http://www.youtube.com/watch?v=QcBpDVzBPMk&feature=youtube_gdata_player

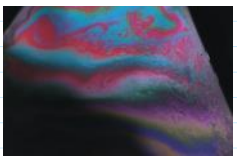
FLOW FACILITIES: LIQUIDS

Facility	Lighting	Visualization	Phenomena	Access
ITLL Flume	Strobe or 500 Watt work lights or North Star lights, or new LED floodlights (JH checkout)	Free surface or food coloring. Be sure to bleach water clean. Try poster paint dots for surface flows.	Free surface: weirs, hydraulic jump, inclined flow. Wakes: submerged objects, one can inject dye. Jets: coflow, reverse, transverse. Boundary layers and surface flows.	Sign up for flume time in ITLL. See Christine.Buckler@Colorado.edu ITLL module engineer. North Star lights in Idea Forge
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	JH
Large Fish Tank in ITLL (50 gal)	Strobe or work lights	Food coloring. Be sure to bleach water clean afterwards	Short jets, vortex rings, boundary layers	*Check with JH first. ITLL signup/ checkout
Hele-Shaw cell	Work light or bounced strobe	Food coloring of detergent, corn syrup, water, etc	Saffman-Taylor instability	*ITLL checkout In Media Shack

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



(50 gal)		bleach water clean afterwards	boundary layers	signup/ checkout
Hele-Shaw cell	Work light or bounced strobe	Food coloring of detergent, corn syrup, water, etc	Saffman-Taylor instability	*ITLL checkout In Media Shack.
Small (10 gal) Fish Tanks	Strobe	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.	*ITLL or JH checkout (take home 2 days)
Soap Film Tunnel; high humidity needed.	Diffuse sunlight is best.	Thin film effect	Jets, wakes, shear layers	JH lab. Could use a redesign.
Glitter Tanks (2) 6 foot X 3 inch	LED or other worklights	Glitter (Pearl-Ex), Pearl Swirl or pearlescent	Wake and wave phenomena	*In ITLL Media Shack. Would benefit



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

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

https://www.youtube.com/watch?v=mh4hZbNMEfo
Kline's Flow Visualization NCFMF vid

black PVC half tubes		shampoo		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. 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	Magnetic field lines	Idea Forge? Impossible to clean up spills. Will stain anything. Nontoxic, though.
Glycerin				JH lab. Mix with soap solutions to extend soap film life
Time Machine Droplet Splash System	Had dedicated camera strobes	Reflection and refraction of fluids	Worthington jets, crown splashes	In beta test, contact Kyle Walters or Kyle Hollis for access

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

Equipment Checkout
Please note that this equipment may be either expensive, rare, or both. Students checking out equipment are expected to take responsibility for the equipment. If equipment is lost, stolen, or broken, there are no funds available for replacement or repair (no, CU has no insurance for this stuff).

Equipment	Location	Notes
Stage fog generator (cooled)	*JH	Fog is nontoxic water-based glycol solution. $40/gal., don't waste. Can leave residue.
Stage fog generator, (small)	*ITLL MediaShack or JH	
Zero Blaster ring generator and fog fluid	JH	
Ultrasonic humidifier	*ITLL Media Shack	
4.5" schlieren system (2) Big schlieren (20" diameter, 8' focal length, need 24' dark space)	JH	
	CAMERAS and LENSES	
Vision Research V2011 **High** speed video.	October 24 and 25 only	Prof. Tadd Truscott from Utah State will collaborate.
Olympus I-Speed high speed video system	ME Idea Forge. See Greg Potts.	Training required. Up to 30,000 fps, but is low resolution, and low sensitivity; needs lots of light.
Canon EOS Rebel XT 8 Mpx, no movie mode	See Prof. Hertzberg	
Canon extension tubes (for cheap lenses, no electronic pass thru)	JH	
Canon zoom lens: EF 75-300 mm	See Prof. Hertzberg	Autofocus, but no image stabilization.
Nikon extension tubes	See Prof. Hertzberg	
Nikon 24 mm wide angle lens	See Prof. Hertzberg	
Nikon 50 mm lens	See Prof. Hertzberg	
Nikon macro lens 102 mm	See Prof. Hertzberg	Manual only
Closeup Lenses: +1, 2 4 in 58 mm dia, +2,+3 in 72 mm dia.	JH	
Stereo cameras (film)	See Prof. Hertzberg	

	LIGHTING	
Sunpak Auto 383 Flash (strobe) unit & 25' pc cable	See Prof. Hertzberg	
Nd-YAG pulsed laser, green light	See Prof Hertzberg	Serious safety training required
CW 5 Watt argon ion laser	See Prof Hertzberg	Serious training and a bit of repair required.
Party strobe	JH	
500 W work lights, several sets	ITLL, JH	
Fluorescent shop lights: 3 foot X 2 tubes	JH	
LED worklight pair, on tripod	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),	Idea Forge	
Small white table-top tent, ~2 ft^3	Idea Forge	Provides diffuse white light and control of reflections
black velvet	JH	
Assorted tripods	JH	
Velbon Macro Slider 	JH	Attaches between tripod and camera. Donated by FV alum Nick Travers.
LP Turntable	JH	For study of rotating flows

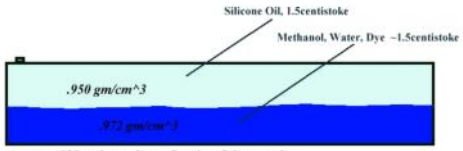
ATOC Equipment

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, but he is only able to help two Flow Vis groups this semester, so contact me if you want to use this equipment.

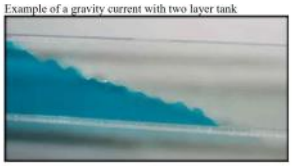
1) Karman vortices – Kalliroscope visualization in a large circular tank

2) Two layer tank with two immiscible fluids



Approx: 125cm long. Layer Depths ~7.5 cm each

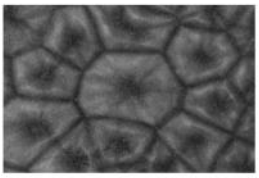
Example of a gravity current with two layer tank



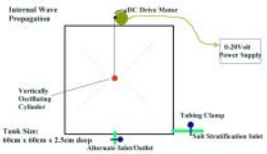
3) Kelvin-Helmholz instability in a 6' clear acrylic tank – two or three layer – dye visualization

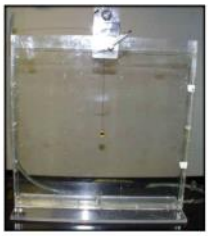
4) Double diffusive convection "Salt fingers"

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

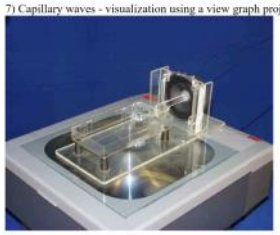


6) Internal gravity waves in a continuously stratified fluid- shadowgraph or Schlieren visualization





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



8) 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

9) Thermal convection – aluminum flake visualization of convection over a heating pad in a 6" layer of silicone oil