06.Overview3

Tuesday, January 25, 2011
4:33 PM

Today

Best of Web Results

Finish Overview: Index of refraction techniques, particle tracking.

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)
4. Image acquisition: Still? Video? Stereo? Time lapse?
5. Post processing, final output. Edit, at least crop the image, consider contrast.

b. Index of refraction techniques

Minute paper, in groups: What is the index of refraction?

2 got speed
12 ~~depth~~ angle change

$$\eta = \frac{c}{v} = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}}$$

eetah

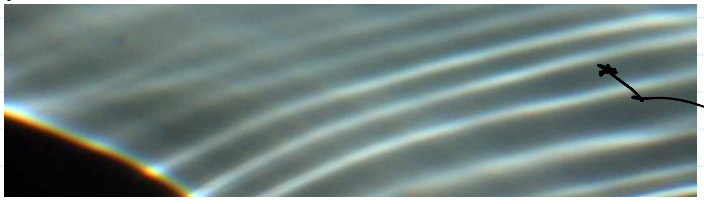
= 1.5 for glass

= 1.3 for water, plexiglas, approximately

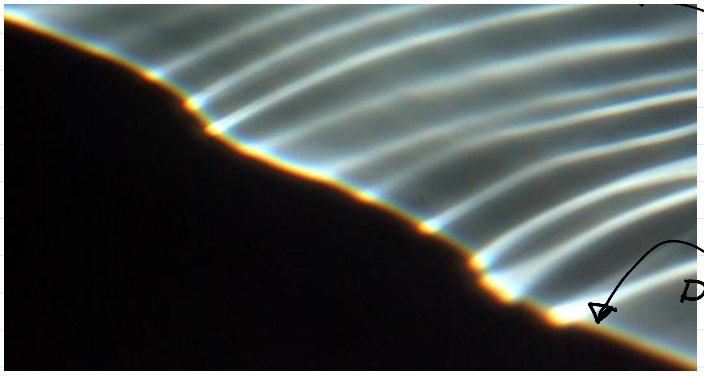
=1.00029 in air

Specific techniques: schlieren, shadowgraphy, interferometry, holography,

Free liquid/gas surfaces, thin film effects (soap bubbles), oil on puddles



CAUSTICS

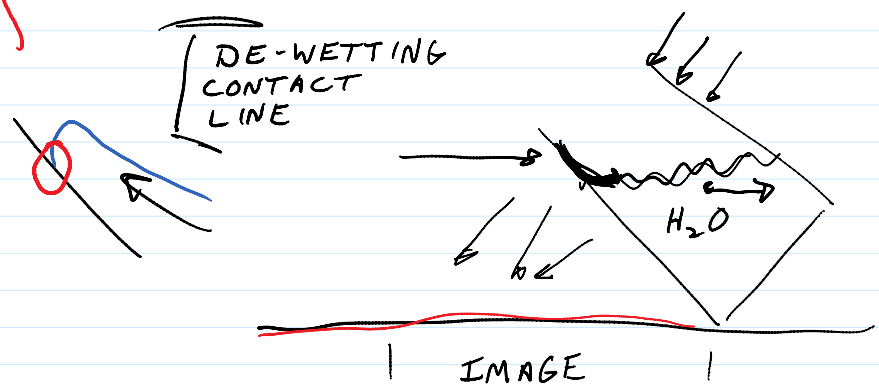


Pasted from <http://www.colorado.edu/MCEN/flowvis/galleries/2007/assignment4/Hnath.jpg>

A rectangular tank, partially filled with water, was tipped on edge. Sunlight projected through the waters' edge to the ground, resulting in Moire interference patterns : CAUSTICS.

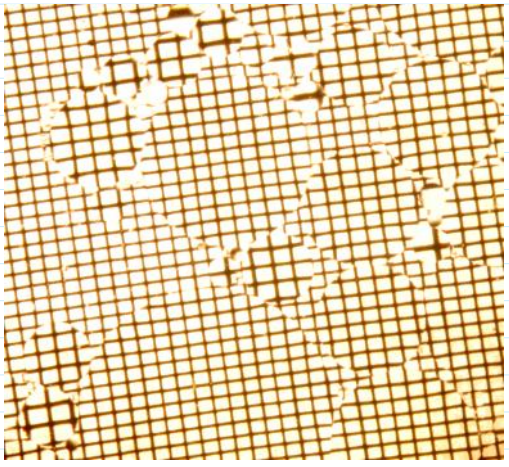
Owen Hnath, Gordon Browning, Tracy Eliasson, Travis Gaskill, Trisha Harrison
Team 2, 2007

SUNLIGHT ~ ALMOST PARALLEL LIGHT RAYS



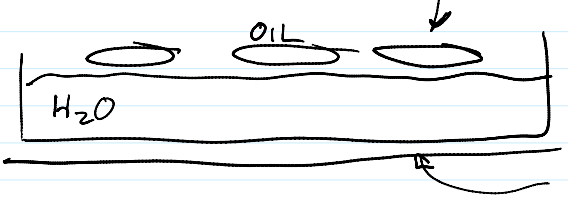
GetWet

Inserted from: <file://C:\Users\hertzber\Documents\01CLASSES\FlowVis\StudentWork07\GetWet\Eliasson\GetWet.tif>



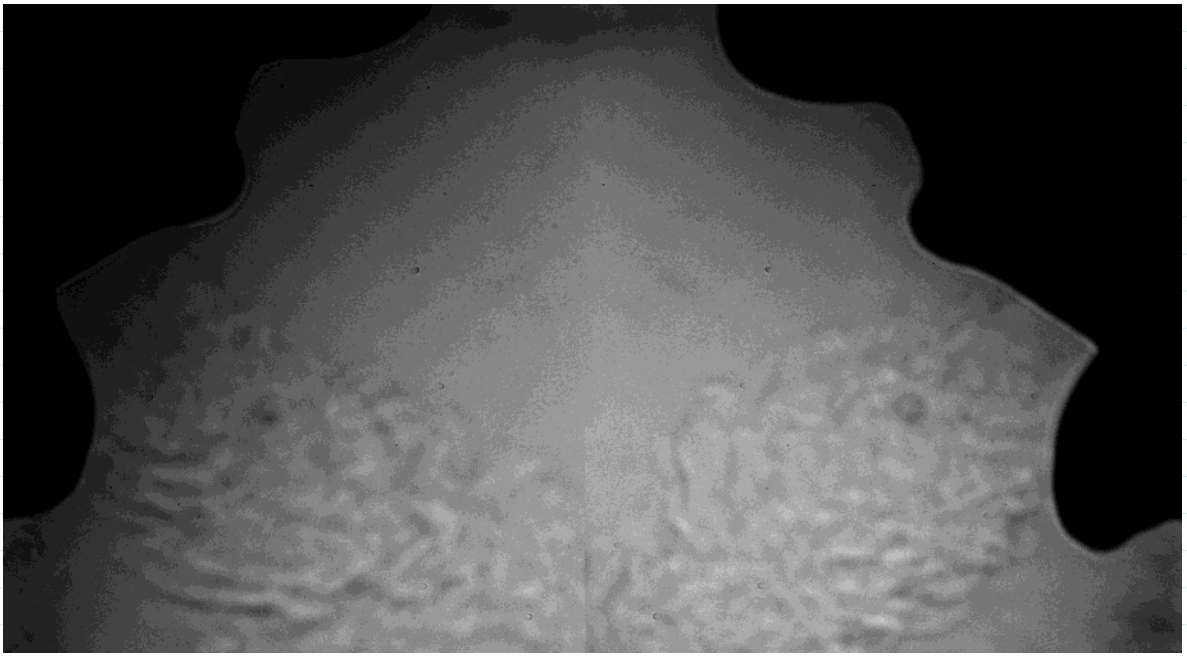
Liquid lenses formed by oil floating on water distort the grid beneath.

Tracy Eliasson
Get Wet 07

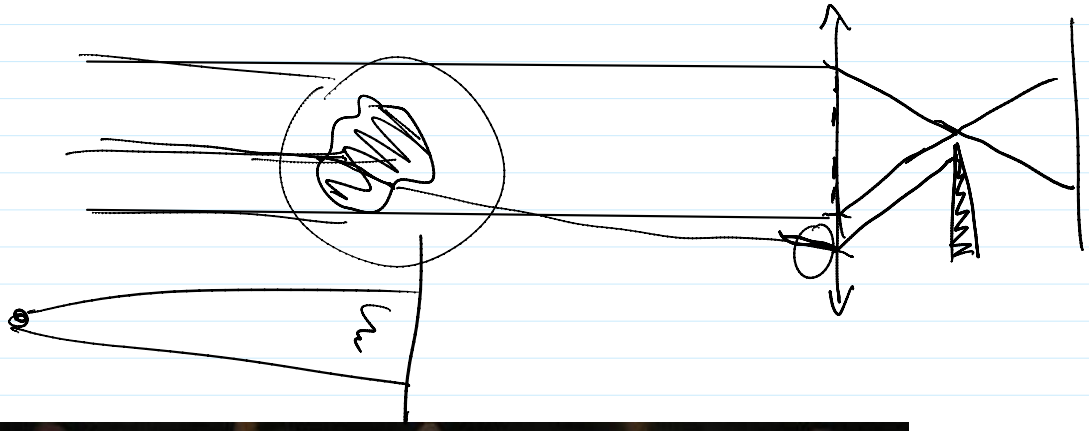


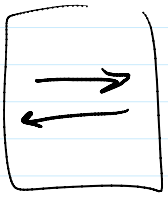
Graph paper

SETTEMBRE CELLAR



Schlieren composite of two human exhalations. Owen Hnath, Group Alpha, Team 3, Fall 2007
http://www.colorado.edu/MCEN/flowvis/galleries/2007/assignment6.html



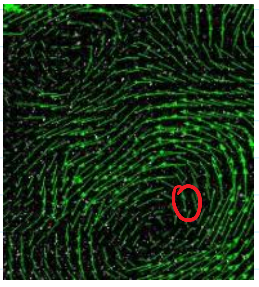


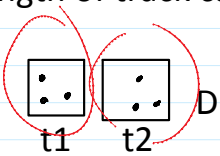
Streaming birefringence
'Blackstock fluid'
Suspension of mica flakes.

http://www.laminarsciences.com/

c. Particle tracking techniques

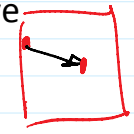
Individual particles are seen. Can be qualitative or quantitative (Particle Image Velocimetry, PIV).
With motion blur, length of track can indicate speed.





Divide image into subwindows

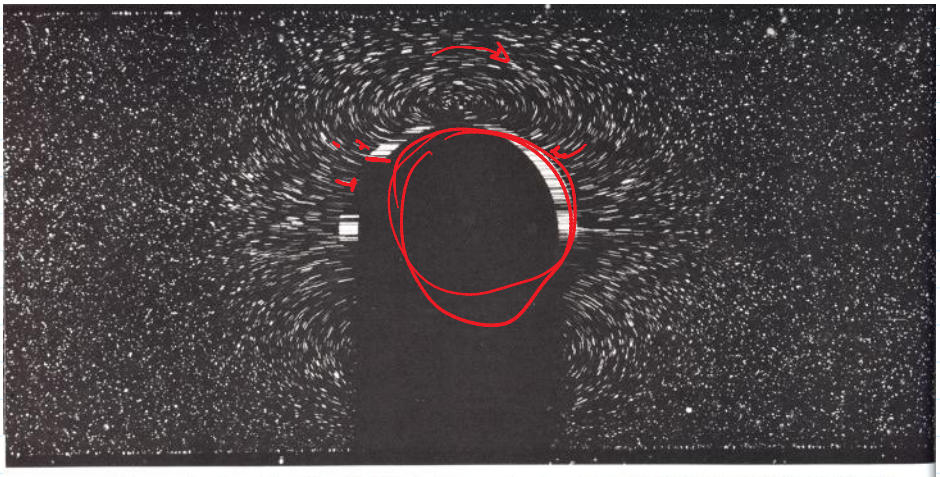
Cross-correlation give displacement vector



$$\frac{\Delta \vec{x}}{\Delta t} = \text{VELOCITY}$$

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>

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*

Pearl-Ex

GUIRY'S Pearl & Folsom