18.357: Lecture 20

#### **Drops and bubbles**

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#### The surf zone: bubble creation via mixing



# **Bubble production via cavitation**







#### **Bubble creation via exsolution of dissolved gas**



#### **Bubble creation via exsolution of dissolved gas**





#### Bond number

# **Bubbles with helical paths**







#### Bond number

#### **Spherical cap bubbles**









stabilized to Ra-P by surrounding fluid vortex ring



#### **Bubble death may create droplets**



# A self-healing bubble



#### **Cleaning via bubbles**



most biomaterial/waste is surface active, sticks to bubble surfaces

# Drops

# The surf zone: a source of droplet birth



#### **Bubble burst**



# **Break-up of a fluid jet**



# **Drop impact on water**



### **Drop generation at a sheet's rim**







# Fluid fishbones







# **Skipping stone**



C. Clanet

# The cough

1



# The sneeze

1





#### Contrails





### The Crow instability



### **Falling water**



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#### Vibrational modes of a low viscosity drop on a viscous bath



Gilet et al. (2008)

# **Drop impact on a hydrophobic solid**







# More vigorous drop impact







# Roisman (2001)



#### Vandam et al. (2004)

## Splashing behavior depends on ambient air pressure



Nagel (2005)

# **Bouncing drops**



# **Drop-drop coalescence**



# The bouncing jet



# **Skipping drops**



### The coalescence cascade



#### The coalescence cascade



Discovery Channel's `Time Warp'

Water Drop Coalescing Into Methanol A Film by: Hamarz Aryafar All work preformed at: UC, Los Angeles Complex Fluids and Interfacial Physics Labratory Advisor:Pirouz Kavehpour

#### Rain drop hits a puddle

Martin Waugh



#### The Worthington jet



# Worthington jet

# Subsurface vortex

Sheet ejection

#### Rain hits a puddle



What forms do we expect?

#### **Fluid-fluid impact**





#### What forms do we expect?

#### Drop impact on water: drop death, bubble birth, drop rebirth

