The fluid dynamics of Incy Wincy spider

TD Dang

Incy Wincy spider climbed
up the water spout

Down came the rain and
washed the spider out

Out came the sunshine and
dried up all the rain

And Incy Wincy spider
climbed up the spout again

The flow of water

Continuity

$$\nabla \cdot \mathbf{u} = 0,$$

"mass"

$$\rho \left(\frac{\partial \mathbf{u}}{\partial t} + (\mathbf{u} \cdot \nabla)\mathbf{u} \right) = -\nabla p + \mu \nabla^2 \mathbf{u} + \mathbf{f}$$

external forces

acceleration w.r.t time

acceleration w.r.t position

pressure

viscous forces

F = m x a

Assumptions

- Steady flow
- 2-dimensional lol

$$\nabla \cdot \mathbf{u} = 0,$$

$$\rho\left(\frac{\partial \mathbf{u}}{\partial t} + (\mathbf{u}\cdot\nabla)\mathbf{u}\right) = -\nabla p + \mu\nabla^2\mathbf{u} + \mathbf{f}$$

F = m x a

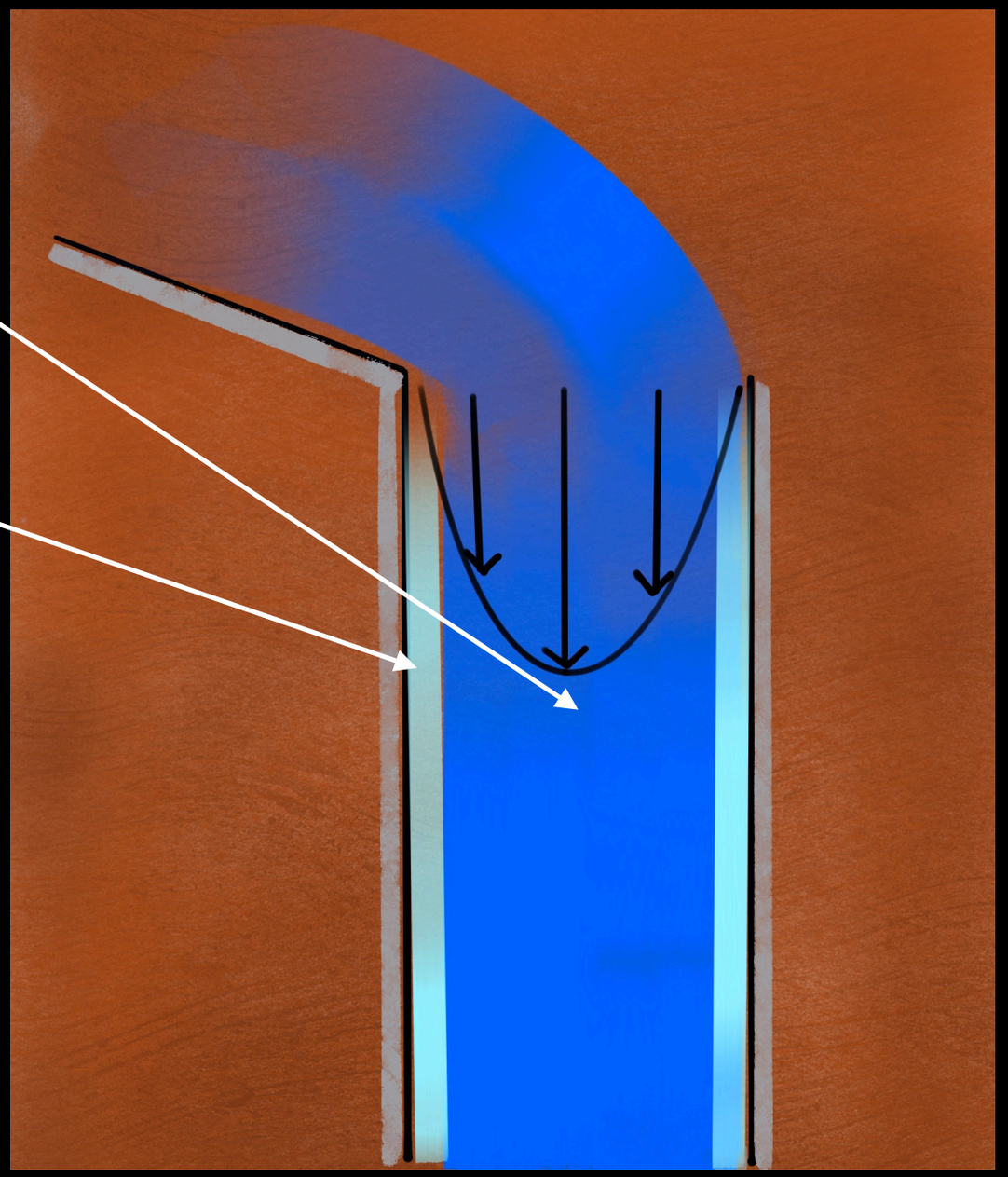
The flow

external & inertial forces matter

$$\nabla \cdot \mathbf{u} = 0,$$

$$\rho(\mathbf{u} \cdot \nabla)\mathbf{u} = -\nabla p + \mu \nabla^2 \mathbf{u}$$

*they don't



An experiment

pipe = straw

spider = chia seed

turbulence = my hands shaking

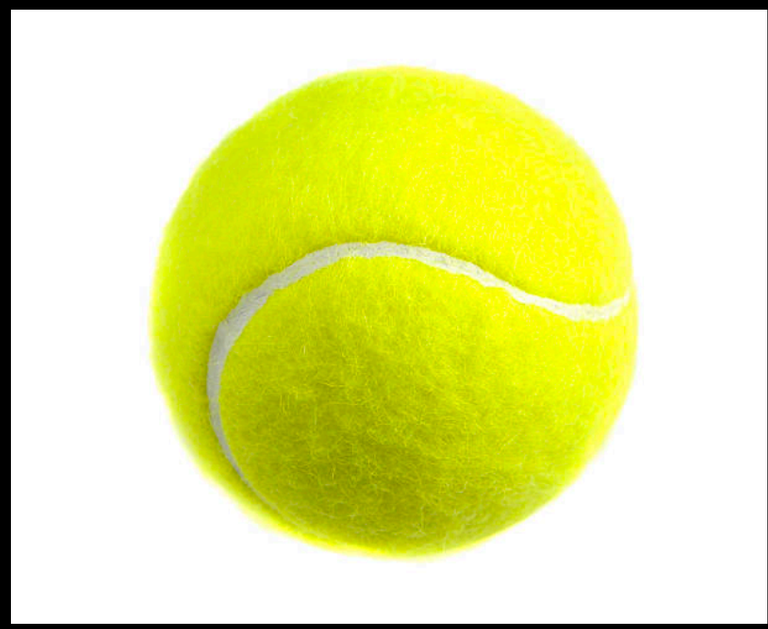
photo credits: Peach Semolina


VEGEMITE
YEAST EXTRACT
*actual size

CHONKY DONKY

-spider

=



CHONKY DONKY

-spider

gravity

CHONKY DONKY

-spider

Thanks for listening!

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