"Stream Line" - path of a tiny particle in fluid.
Cut a hole in the bottom.

\[ p_1 = p_2 \]

\[ V_1 \neq V_2 \]

\[ \rho g V_1 + \frac{1}{2} \rho V_1^2 = \rho g V_2 + \frac{1}{2} \rho V_2^2 \]

\[ V_1^2 - V_2^2 = 2gh \]

Incompressible

\[ A_1 V_1 = A_2 V_2 \]

\[ V_2 = \left( \frac{A_1}{A_2} \right) V_1 \]

\[ (1 - (\frac{A_1}{A_2})^2) V_1^2 = 2gh \]

\[ V_1^2 = \frac{2gh}{1 - (\frac{A_1}{A_2})^2} \]

As \( A_1/A_2 \to 0 \),

\[ V_1^2 \approx 2gh \]

(Torricelli's Principle) \( \to \) dense object would not reach.
Curved balls (ping pong)

From above:

\[ \text{straight} \]

\[ \text{"Halo"} \]

\[ \text{curves} \]

\[ \text{seems like point } a \]
\[ \text{has higher velocity} \]

Key point: some air is dragged along with ball

Jump into rest frame of ball

Non spinning
Ball + air spinning

Add the two together (in the rest frame of ball)

[Diagram showing air flow and forces]

Roughening... big effect!
Fields of flow

Constant velocity

Imagine transverse area

\[ v_1 A_1 = v_2 A_2 \quad \text{when } A_1 = A_2 \]

\[ v_2 = v_1 \]

\[ v_2 > v_1 \]
Spin a cup: \( \omega = \frac{V}{R} = \text{constant} \)

Down a drain:

**CENTRAL FORCE**

\[ L = \text{constant}! \]
\[ L = mvr, \quad v \propto \frac{1}{r} \]