# Fire pulses

A 2024 Youtube video (https://www.youtube.com/watch?v=SqhXQUzVMlQ) has now more than 5 million views. But until now, the pulse behavior has not been scientifically investigated.

During the 2025 summer REU and the 2025/26 academic year, we investigated the effect of width, height, and annular radius on the flame pulse velocity (first manuscript to be submitted soon).

We use a Zippo lighter fluid to create a thin layer of the volatile liquid, creating a combustible vapor layer, which can be ignited. Blocking the motion in one direction can create a single pulse which can move around the channel for several minutes.


Figure 2: **Left:** Zippo Lighter Fluid bottle and acrylic mold containing eight channels. The annular radii vary from $R = 30\,\mathrm{mm}$ to $R = 120\,\mathrm{mm}$. **Center:** Blue flame pulse propagating in an acrylic annular channel. **Right:** Close-up of a propagating flame pulse in an aluminum annular channel. Hovering of the pulse above the fluid is clearly visible.

Many experimental directions can be pursued after the initial year. Options are

1. Effect of the fluid height on the pulse speed.
2. Effect of the width-to-height ratio (at constant cross-sectional area) on the pulse speed.
3. Effect of different flammable hydrocarbons on the pulse speed.
4. Effect of multiple flame pulses, propagating in the same direction within a channel, on each other.
5. We observed an audible sound of a pulse, propagating in a square-shaped channel, when it hit each $90^\circ$ corner.
6. What is the maximal angle a pulse can propagate through? We tested already successfully an equal-lateral triangle.
7. Effect of non-rectangular channel geometries (e.g., conically widening) on the pulse speed.
8. Effect of lower oxygen concentrations in the ambient air above the channel.