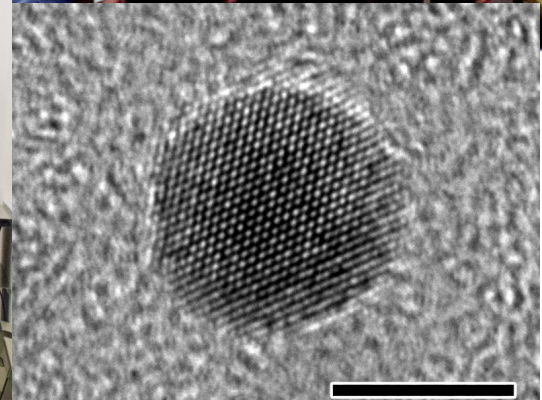


17. Travelling flame

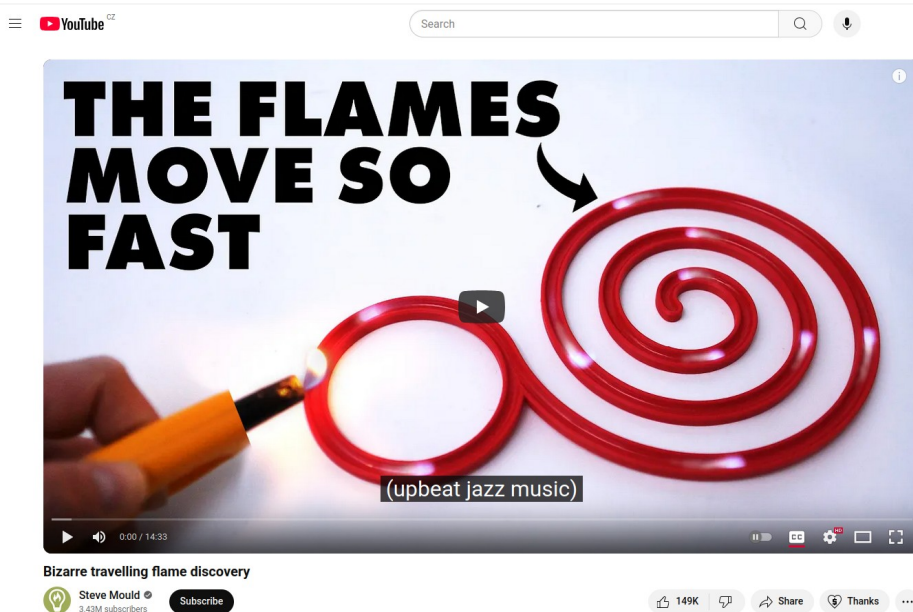
Jozef Veselý

Who am I?

- IYPT 2002 Odesa
- MFF UK
wow: math (ode, pde, ...), equipment, ...
- Phd. in material science
- TEM



Travelling flame

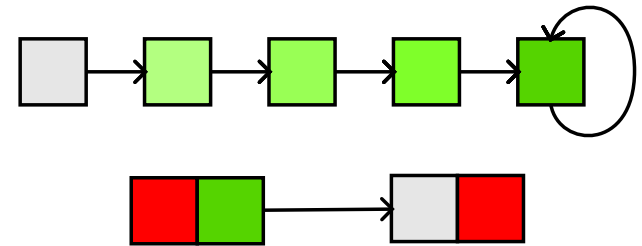
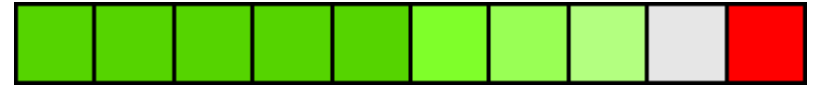


A flame can propagate continuously around a ring-shaped trough containing a thin layer of flammable liquid. Investigate how the characteristics of this travelling flame depend on relevant parameters.

<https://www.youtube.com/watch?v=SqhXQUzVMIQ>

Basic idea

- Excitable media
(universal phenomena
rabbit hole)
- Much more interesting
micro-mechanism and
experiment



Beyond YouTube video

- **Understand** role of relevant parameters
- **Control** the parameters
- **Replicate** the phenomenon

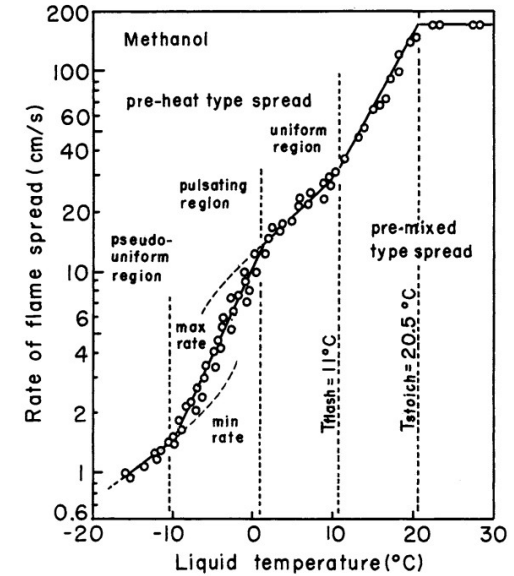
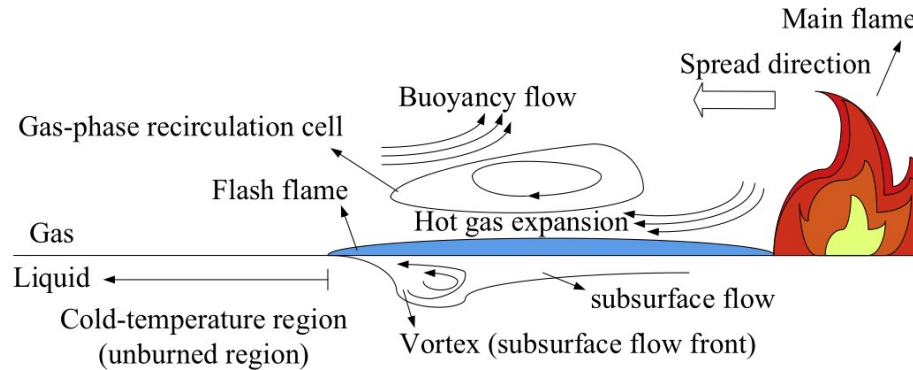
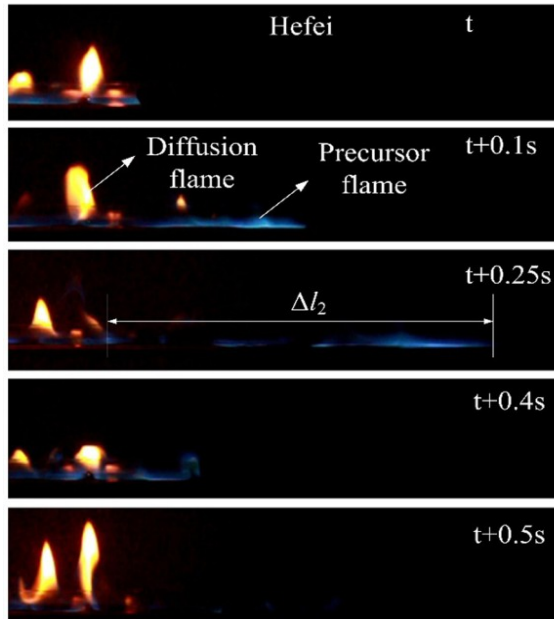
My experiments

- 3D print ~ 2h
<https://www.thingiverse.com/thing:6586043/comments>
- **Lighter fluid** / ethanol
- Not so easy to get working, mostly whole ring gets on fire
- **Thin layer of fuel!**



Flame propagation theory

- IYPT Reference Kit 2026
- **gas-phase vs. liquid phase**



[1] K. Akita, Some problems of flame spread along a liquid surface, Symposium (International) on Combustion 14 (1973) 1075–1083. [https://doi.org/10.1016/S0082-0784\(73\)80097-9](https://doi.org/10.1016/S0082-0784(73)80097-9).

[2] J. Ji, S. Lin, C. Zhao, K. Li, Z. Gao, Experimental study on initial temperature influence on flame spread characteristics of diesel and gasoline–diesel blends, Fuel 178 (2016) 283–289. <https://doi.org/10.1016/j.fuel.2016.03.072>.

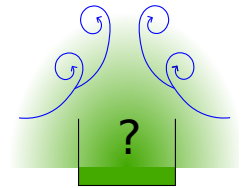
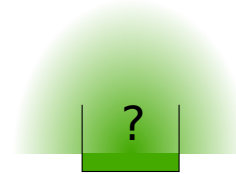
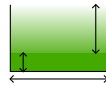
[3] M. Li, S. Lu, R. Chen, J. Guo, C. Wang, Experimental investigation on flame spread over diesel fuel near sea level and at high altitude, Fuel 184 (2016) 665–671. <https://doi.org/10.1016/j.fuel.2016.07.060>.

Relevant parameters

- Fuel <https://www.hudy.cz/cim-a-na-cem-varit-ii-benzinove-varice>

- **Temperature**

- Geometry (loop/line)



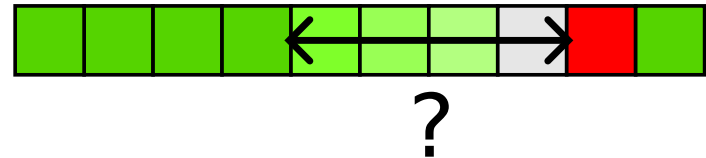
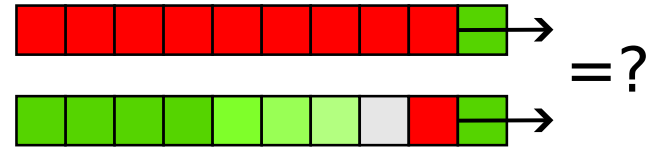
- Surface tension, viscosity, ...

- Oxygen

- Ignition source

Experiment ideas

- Flame speed
- Flash point
- Fire point
- Quenching distance
- **Recovery time**
(minimum repeat distance)



Cherry on top

- demonstrate extraordinary control
- indefinite run time, change parameters online, 2D, send messages, logic gates ...

Thank you!

- Questions?