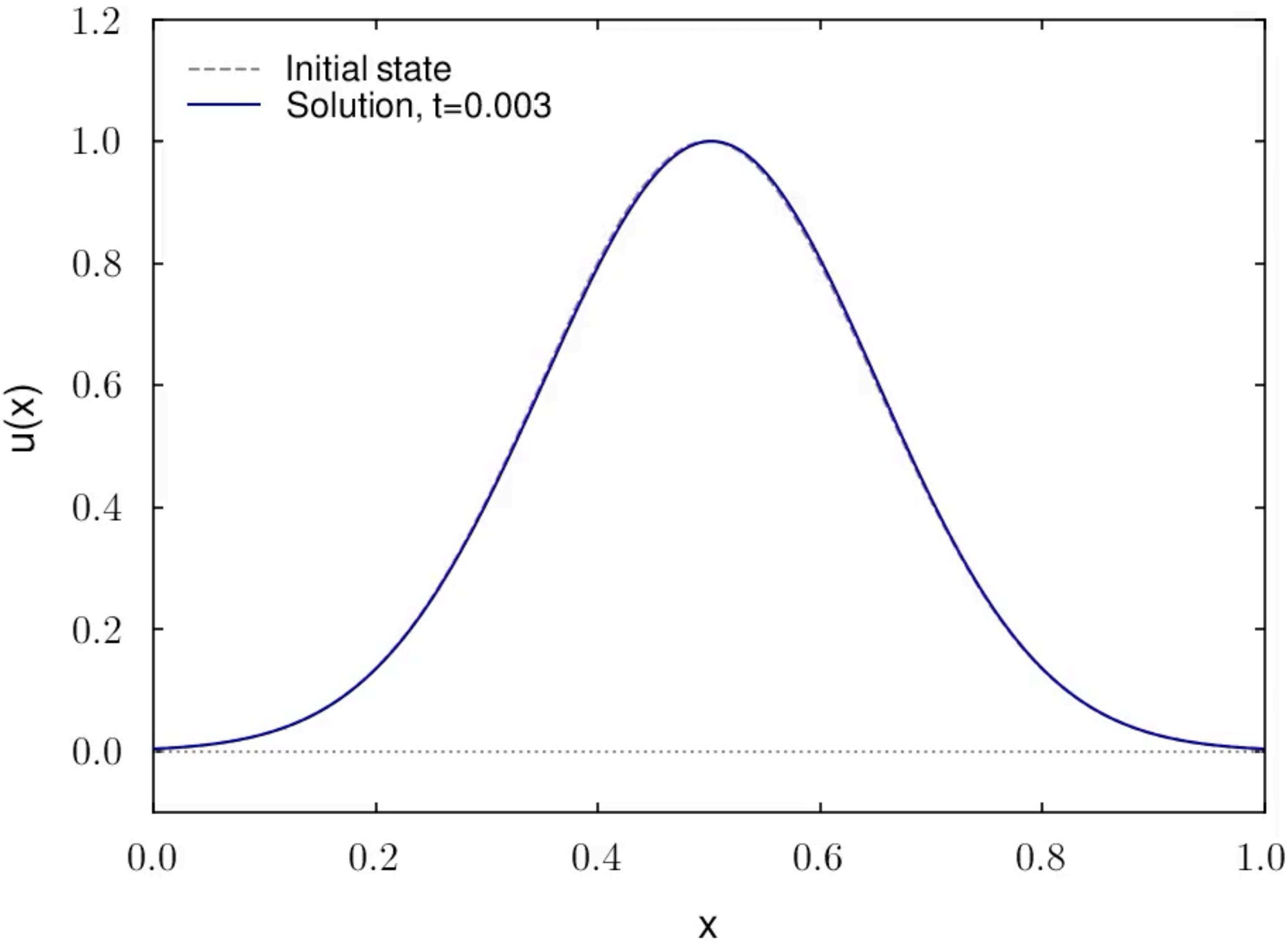
ASTR 670: Interstellar medium and gas dynamics

Prof. Benedikt Diemer

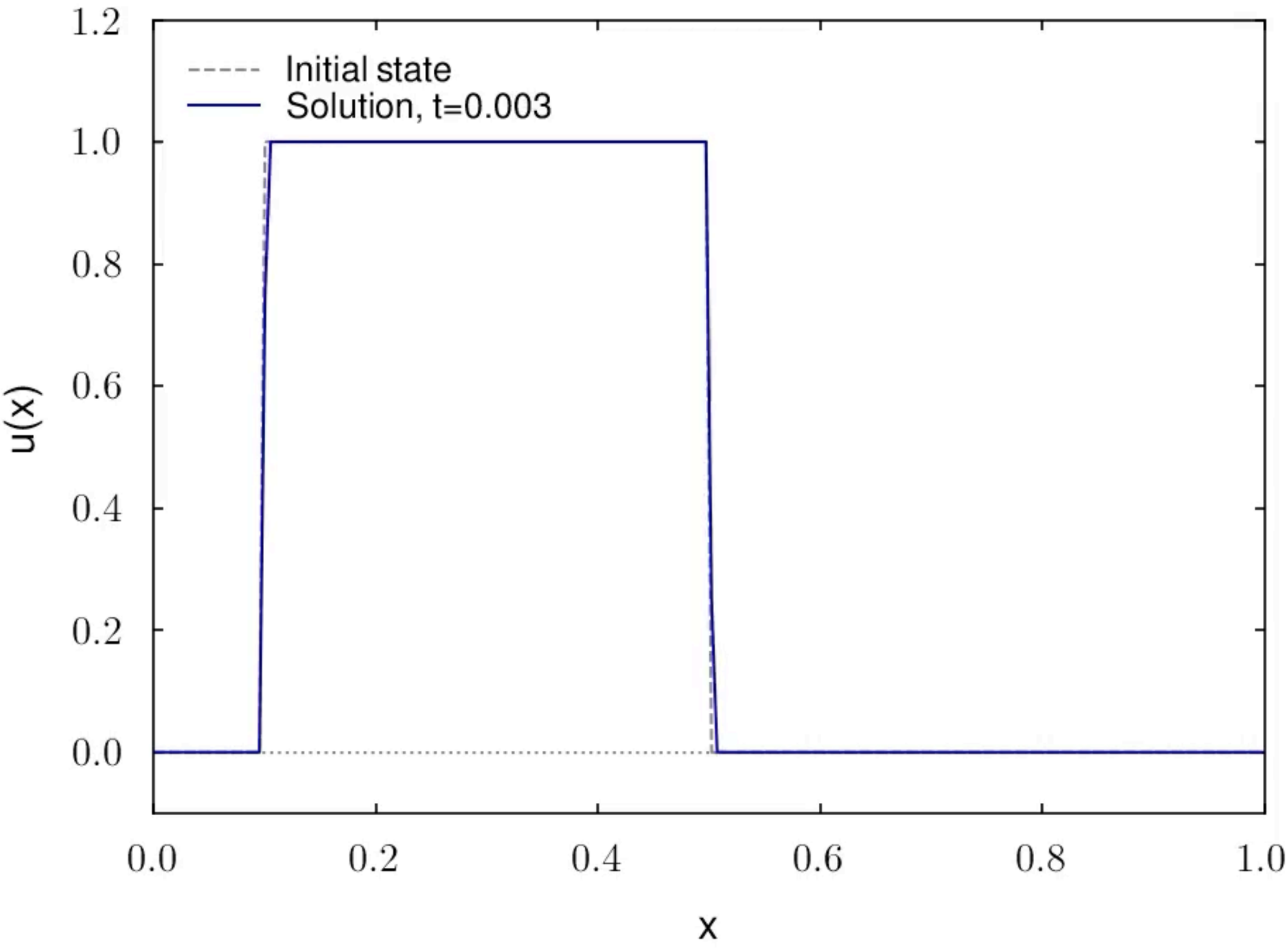
Chapter 7 • Shocks

Why shocks?

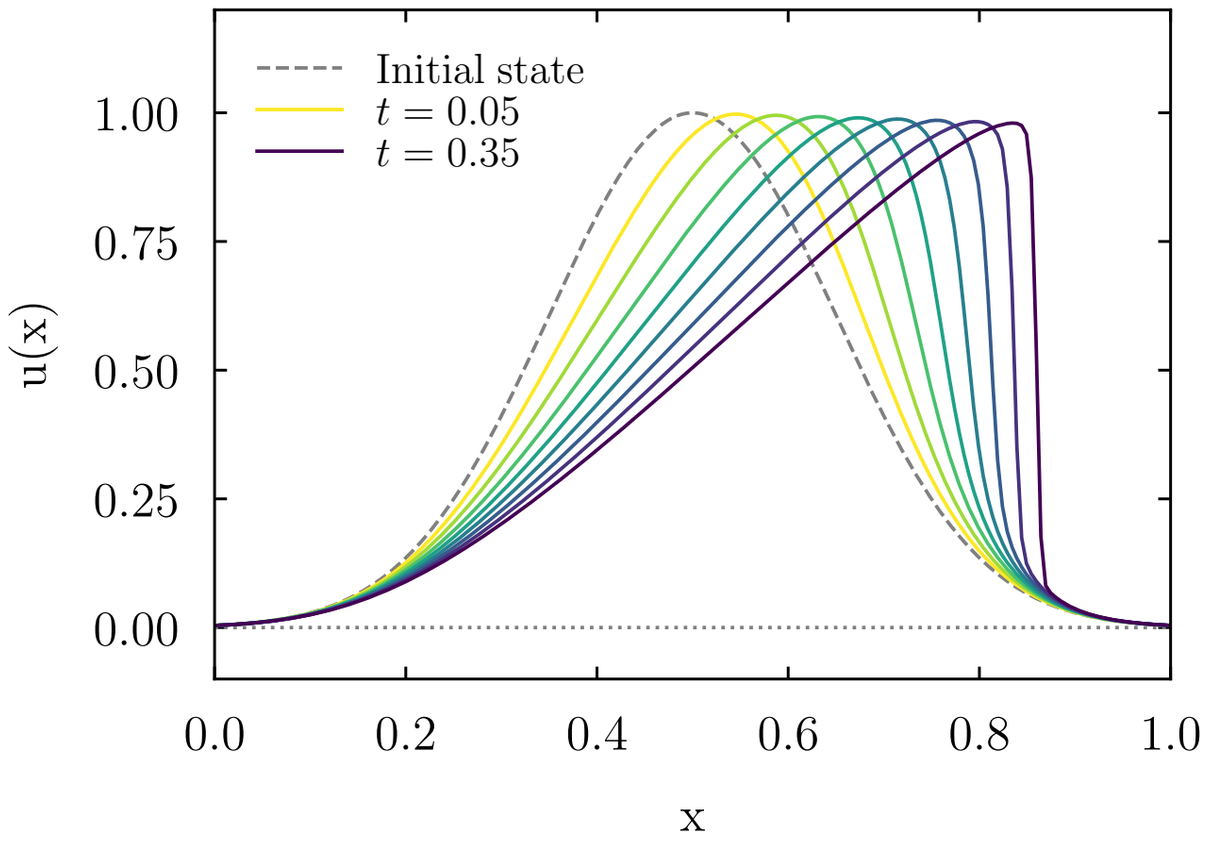
Burgers' equation

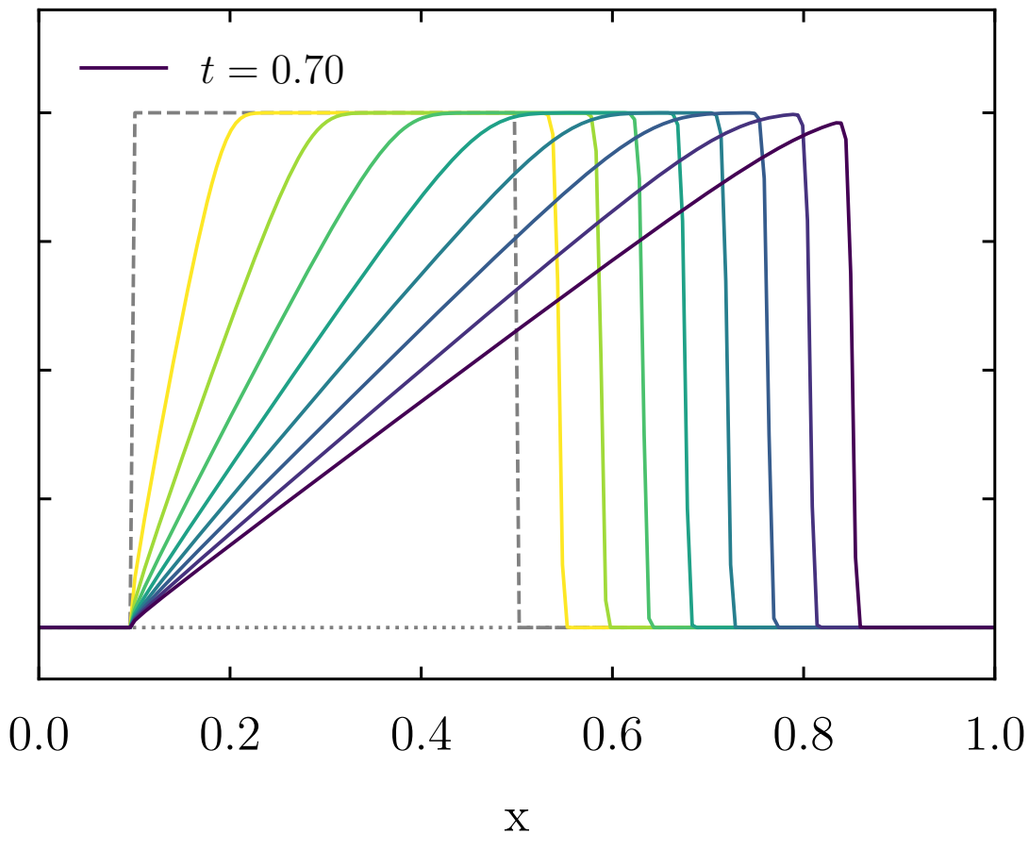


Burgers' equation



Burgers' equation





Burgers' equation

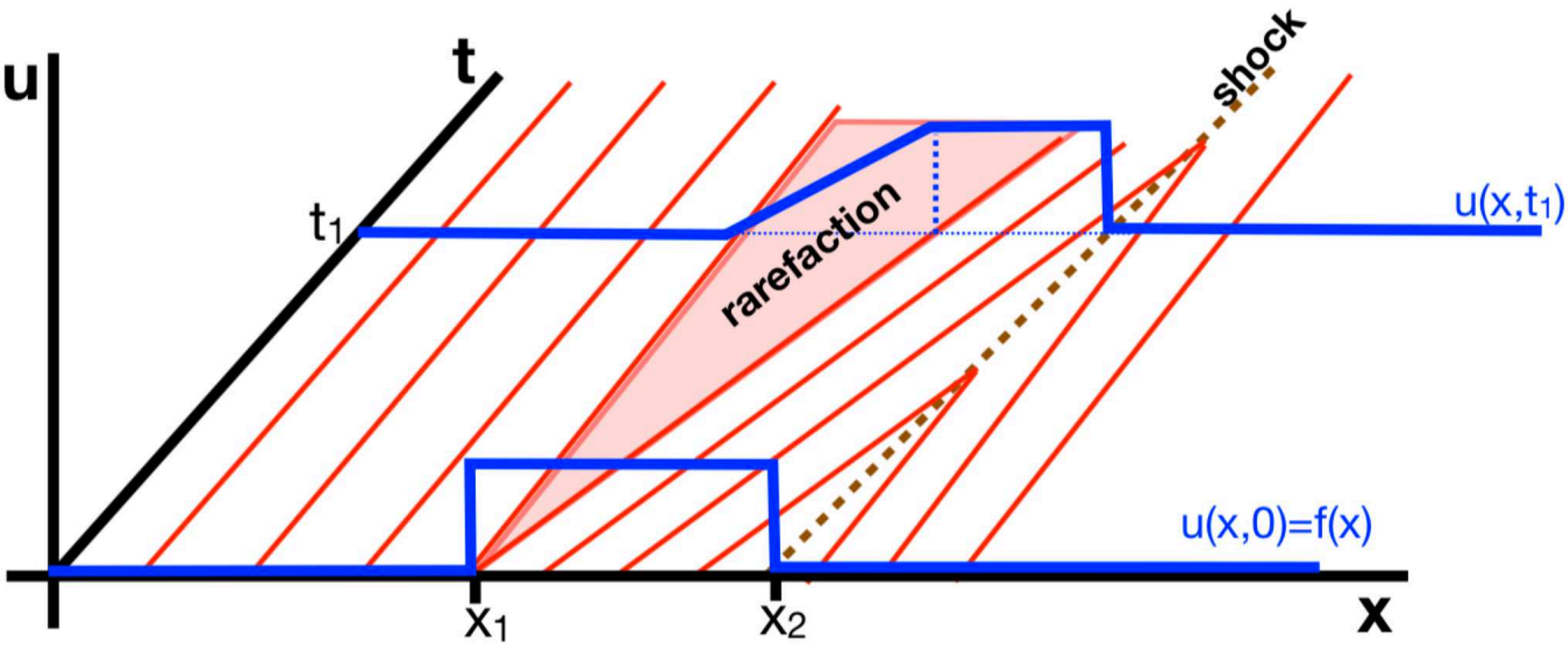
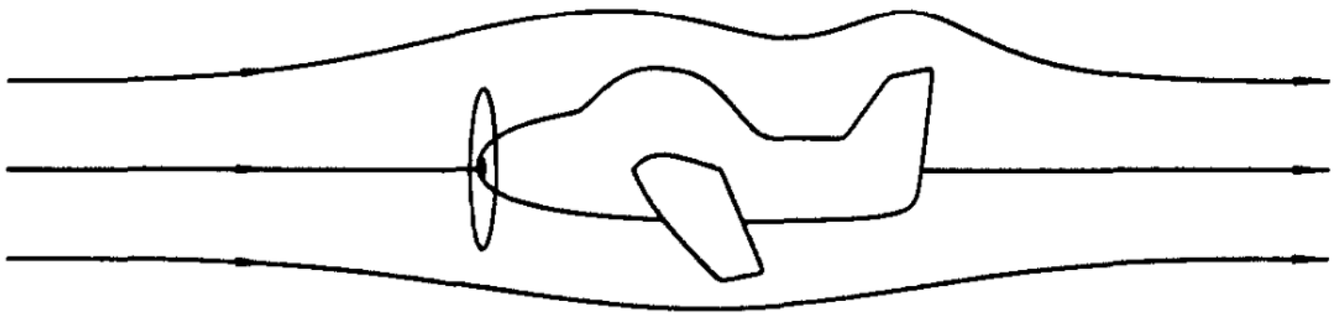


Figure from van den Bosch

Shock physics

Subsonic vs. supersonic



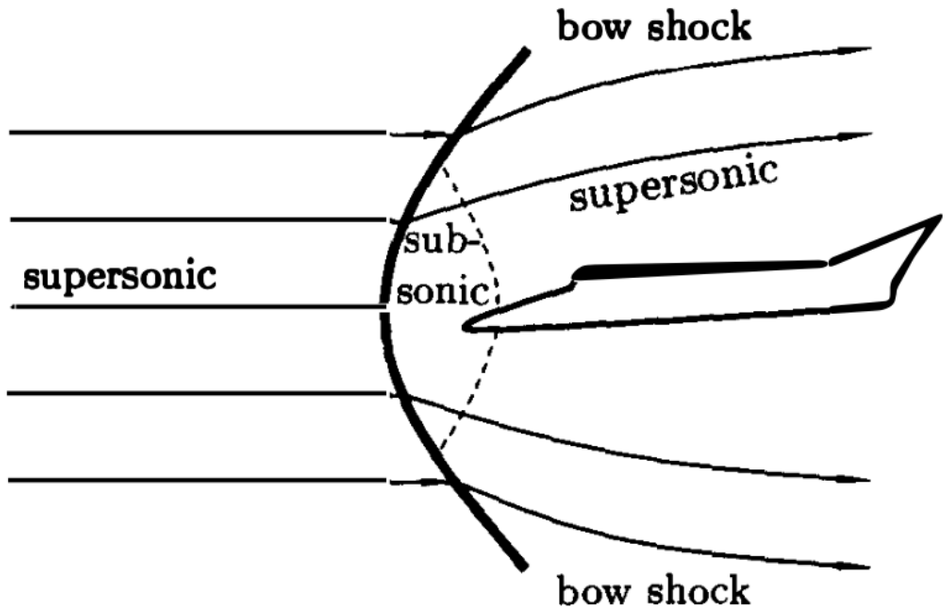


Figure from Shu

Shocks

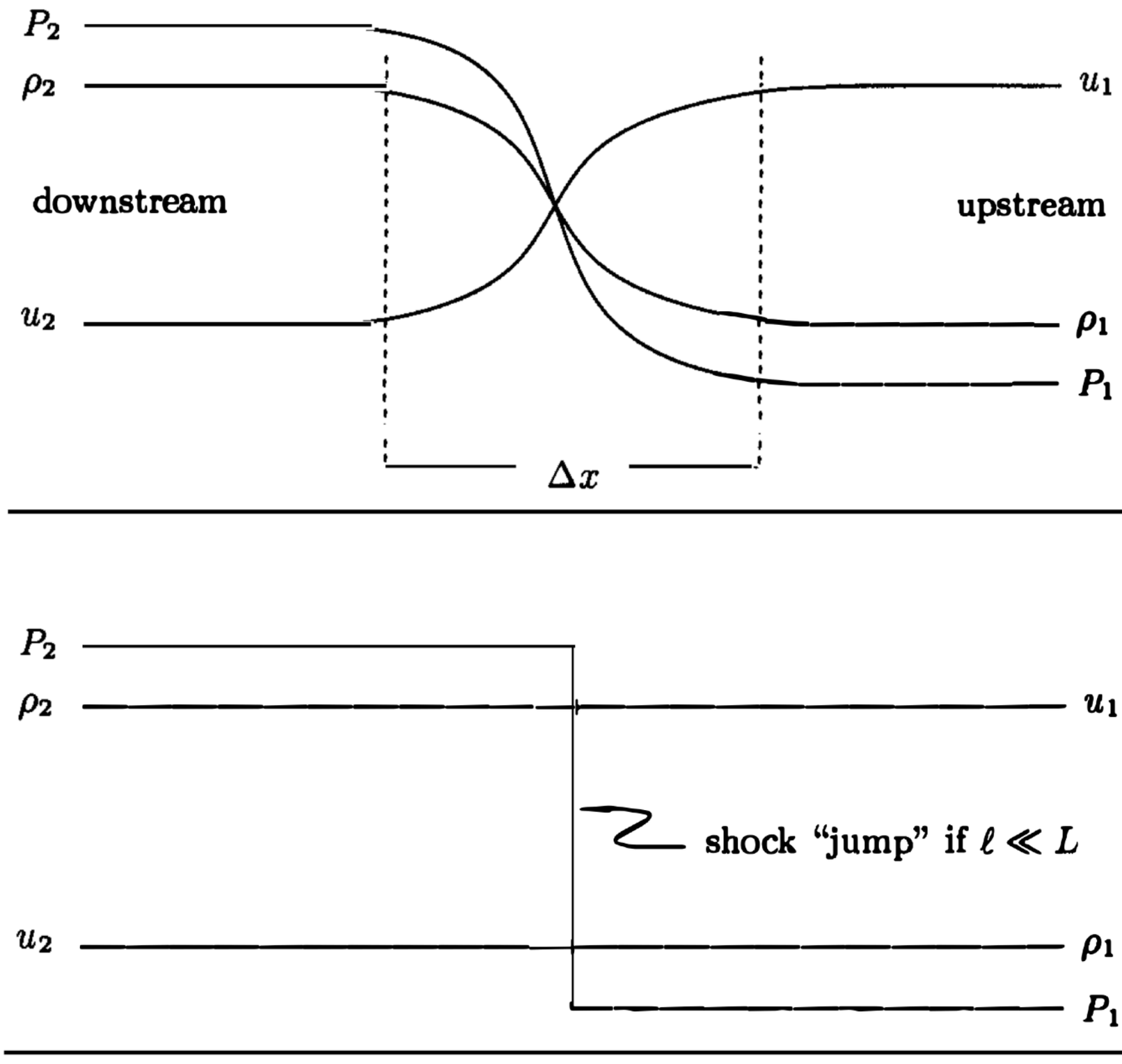
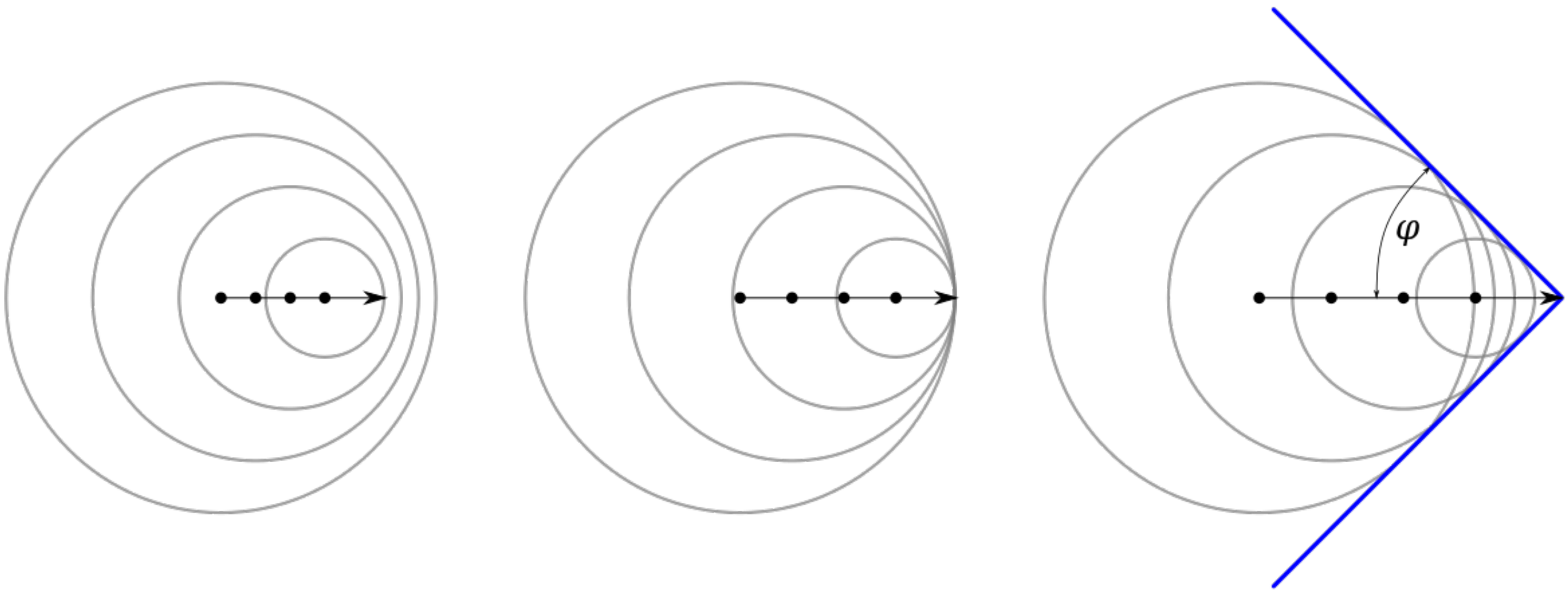


Figure from Shu

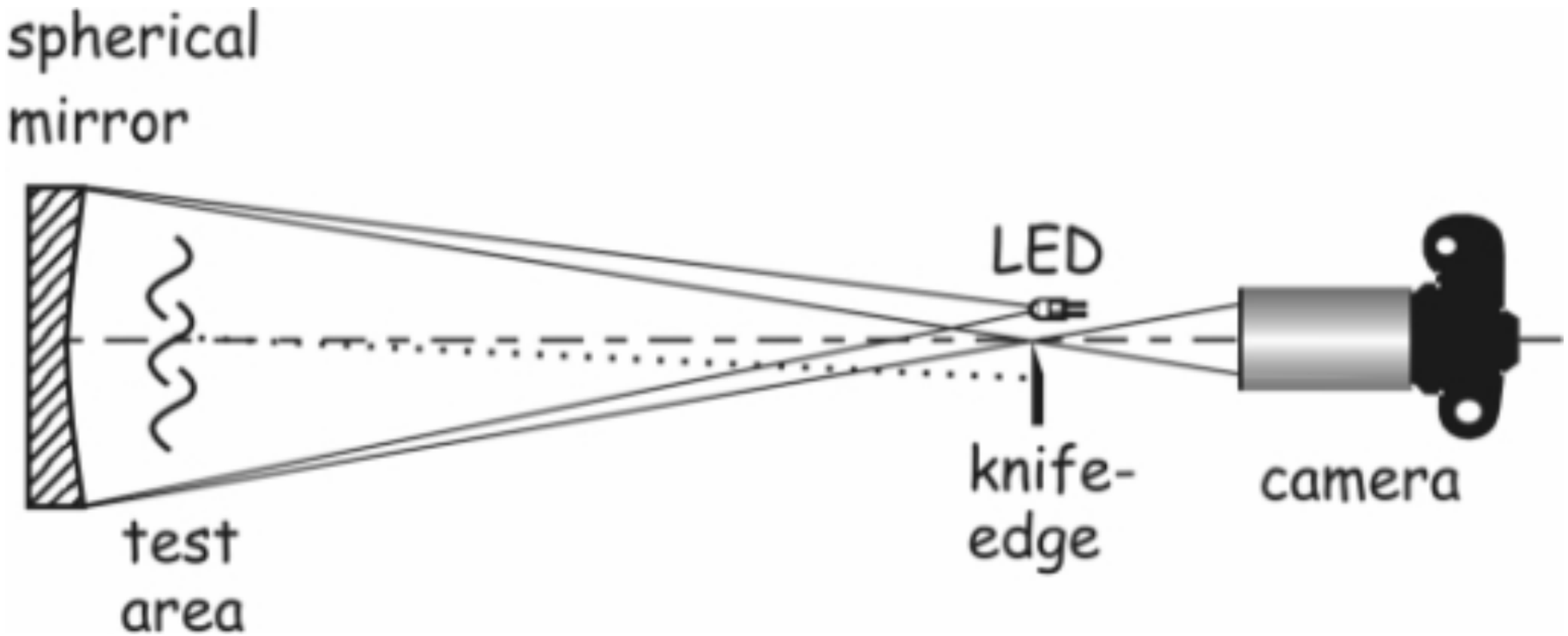
Mach cone



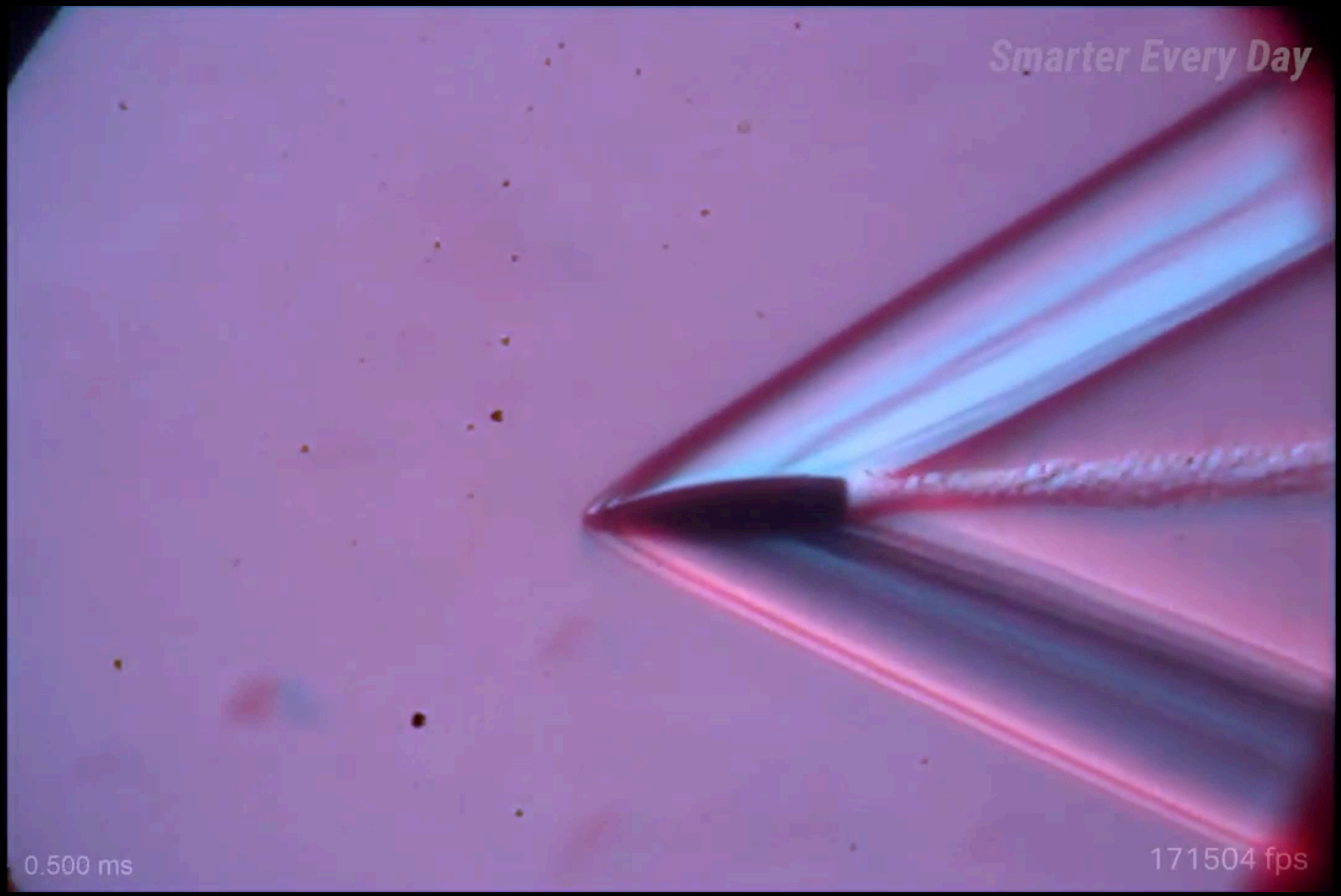
$v < v_s$ $v = v_s$ $v > v_s$

Image: Wikipedia

Schlieren imaging



Schlieren imaging of shocks



Video by Smarter Every Day (youtube)

Mach cone

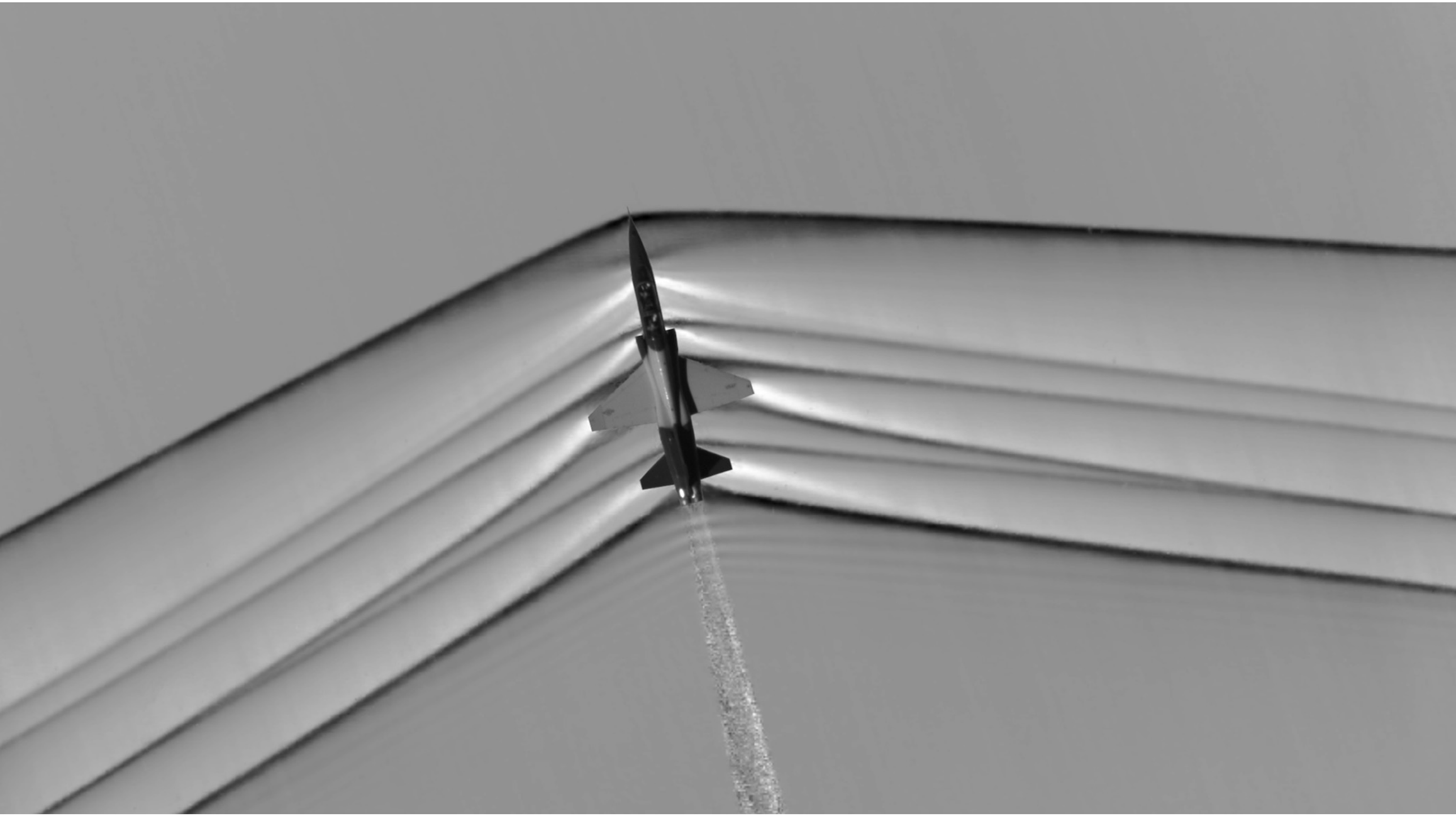


Image: NASA

Mach cone

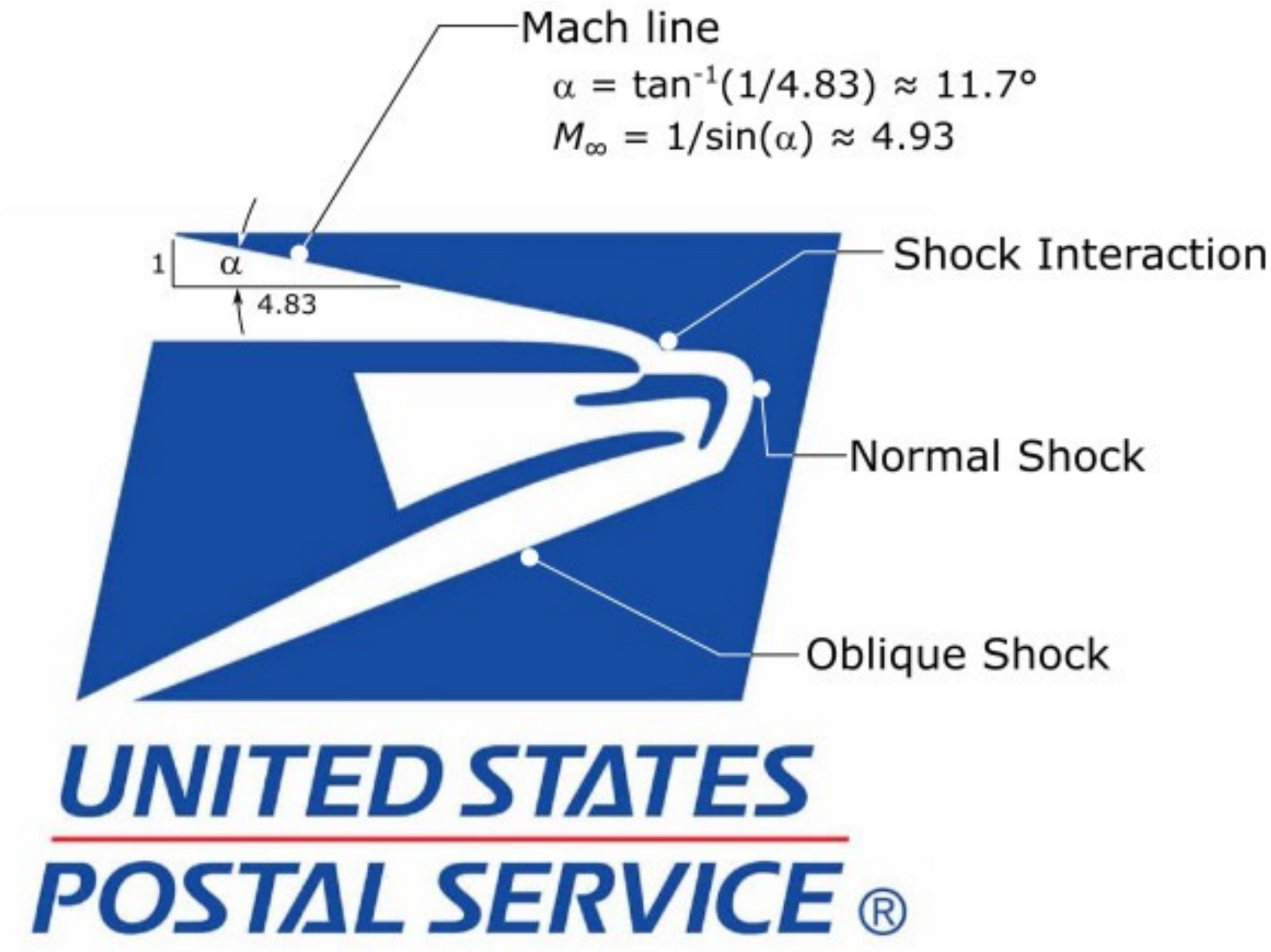
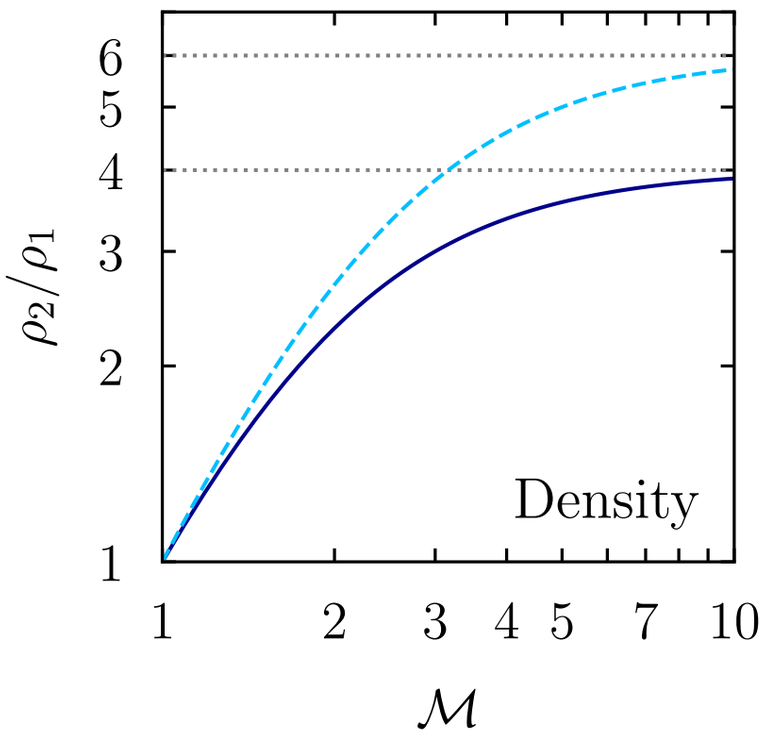
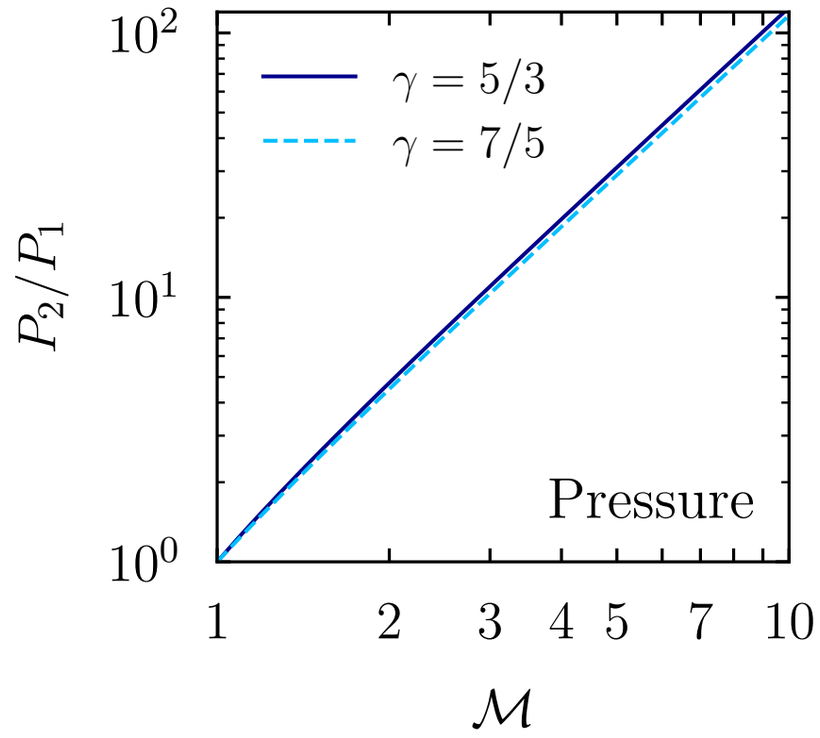
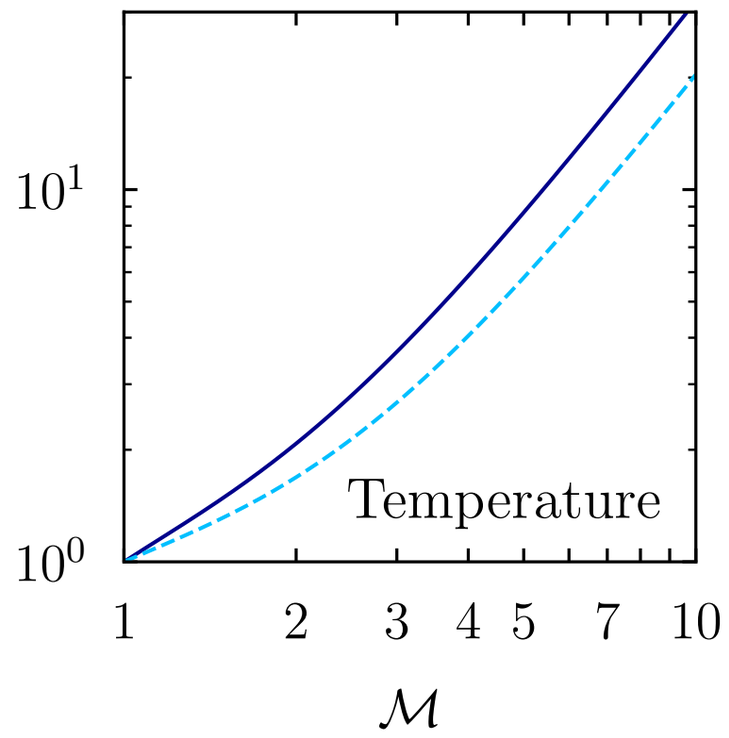


Image: Andrew Higgins

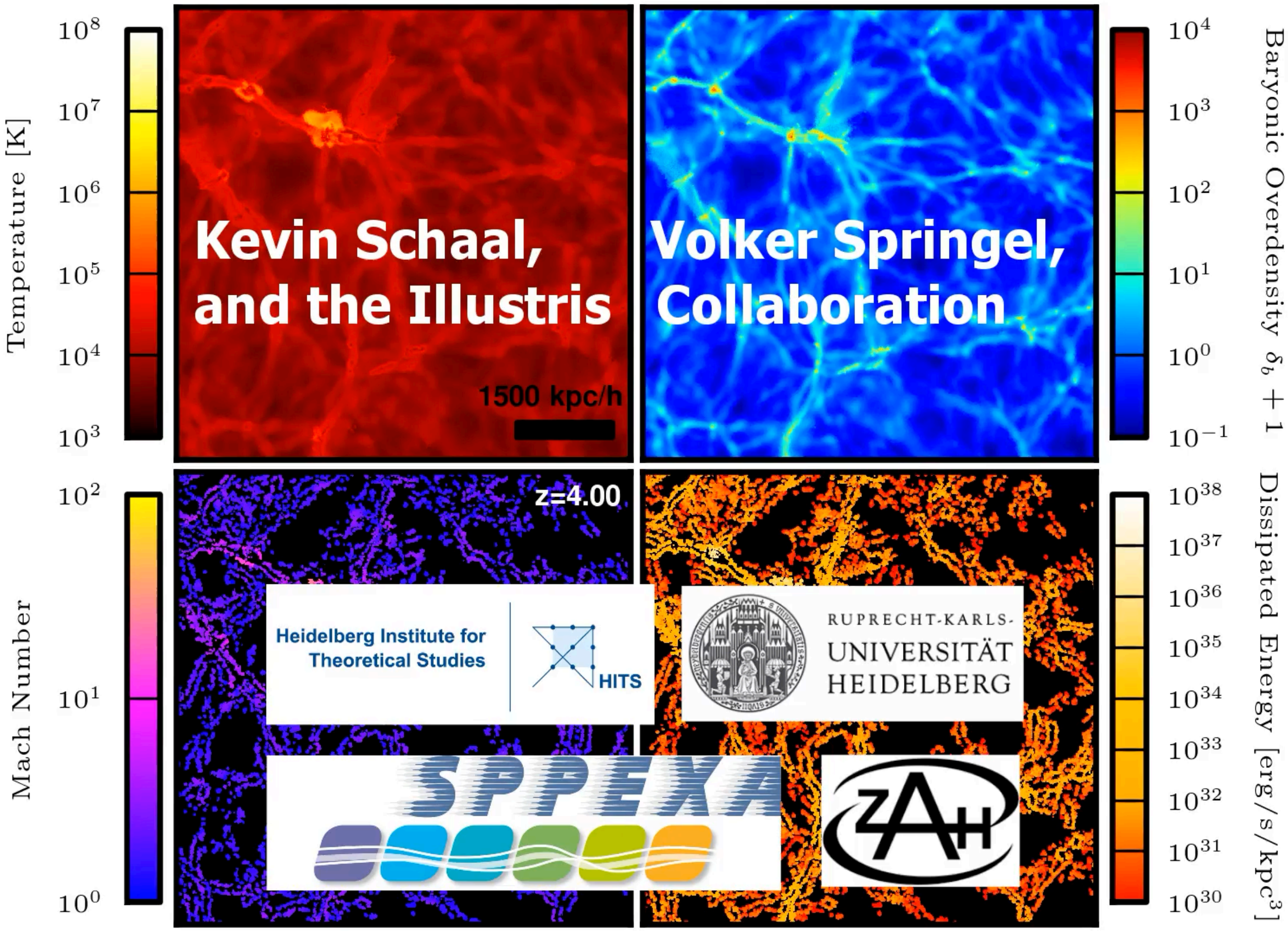
Ideal gas shocks



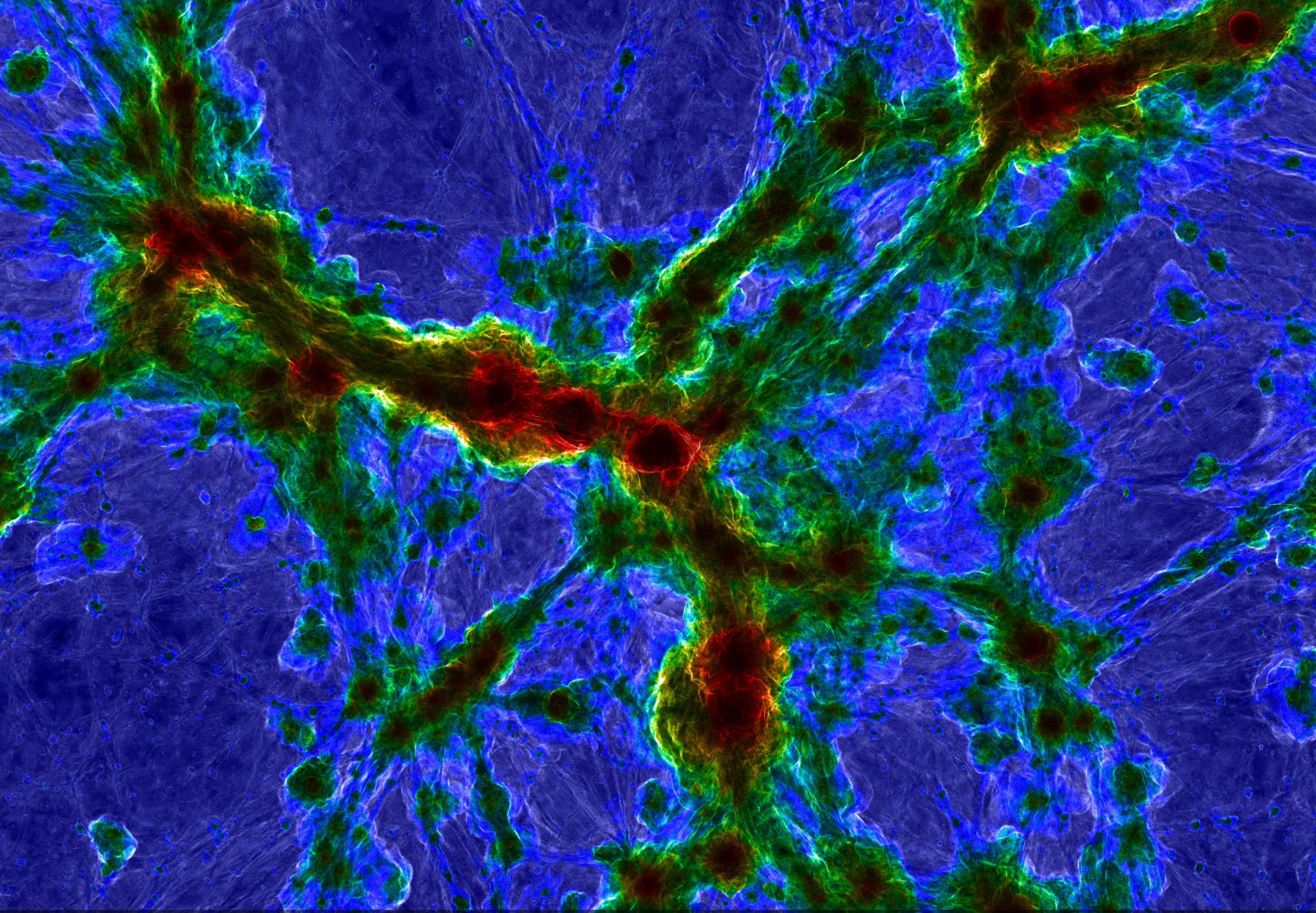




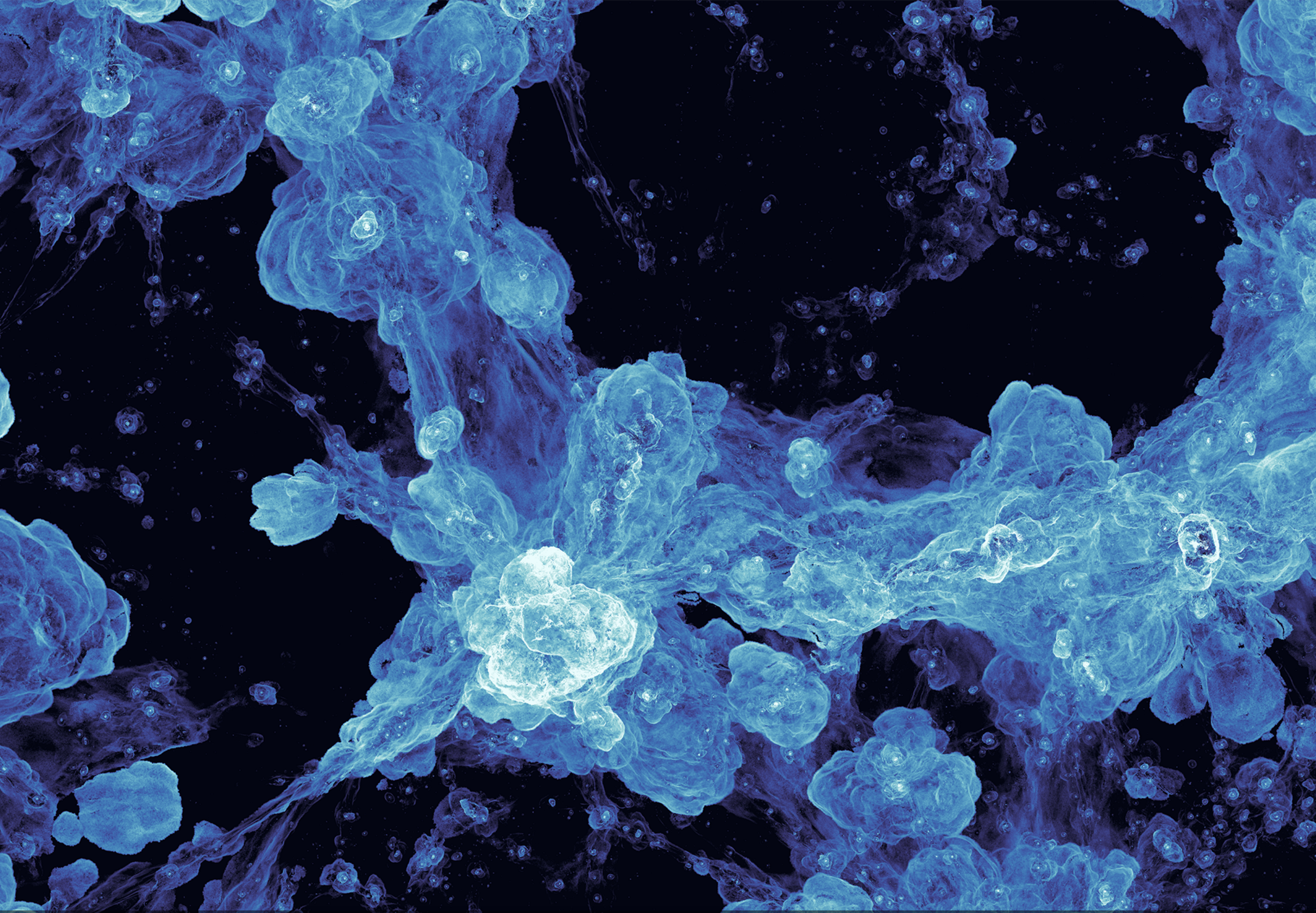
Accretion shocks



IllustrisTNG collaboration / Kevin Schaal (video page)



IllustrisTNG Collaboration • Marinacci et al. 2018 • Naiman et al. 2018
Nelson et al. 2018 • Pillepich et al. 2018ab • Springel et al. 2018 • Weinberger et al. 2017



IllustrisTNG Collaboration • Marinacci et al. 2018 • Naiman et al. 2018
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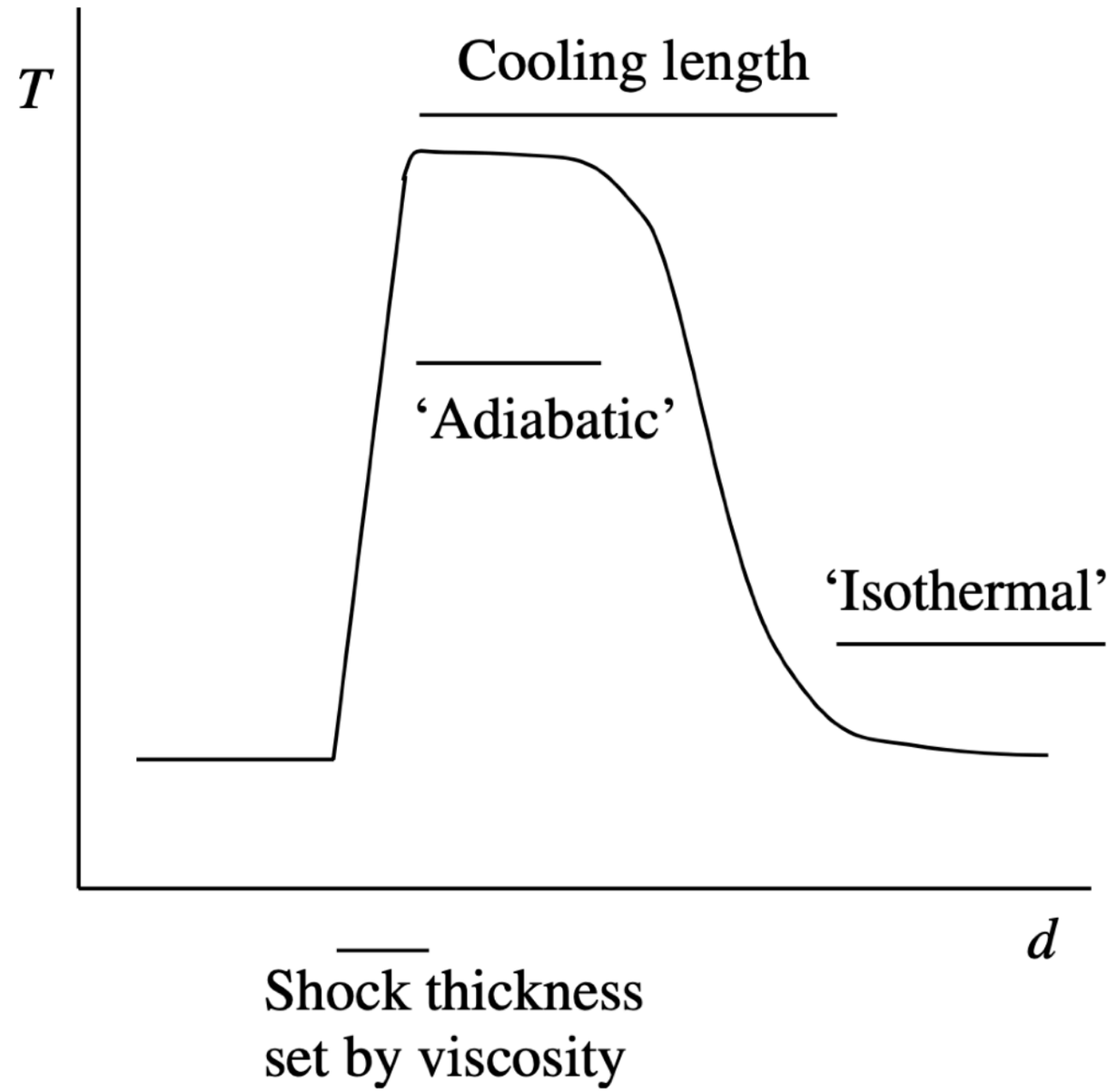
Isothermal shocks

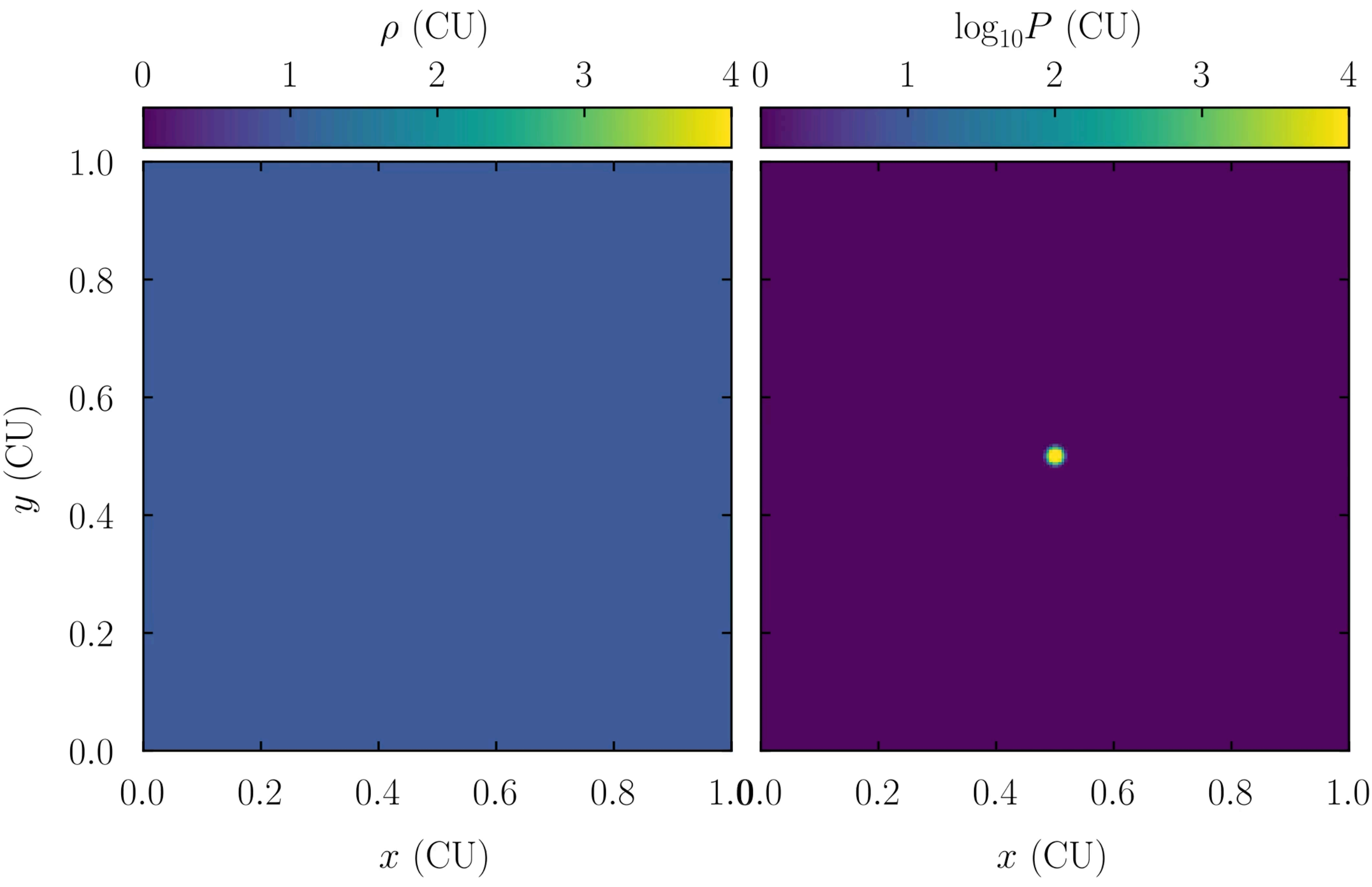
“Isothermal” shocks



Clarke & Carswell

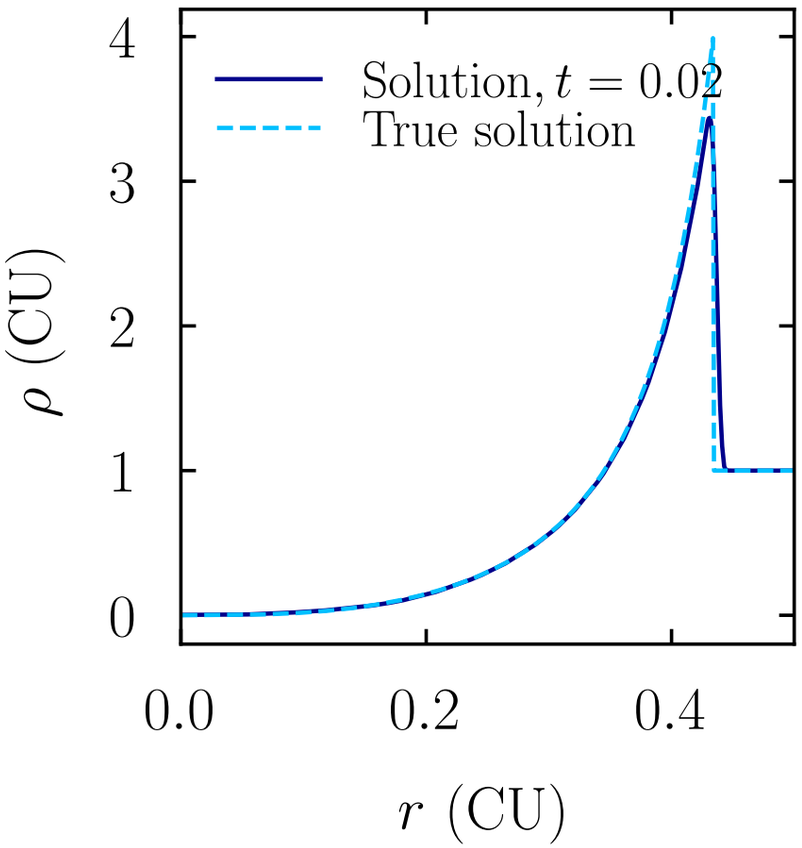
Blast waves

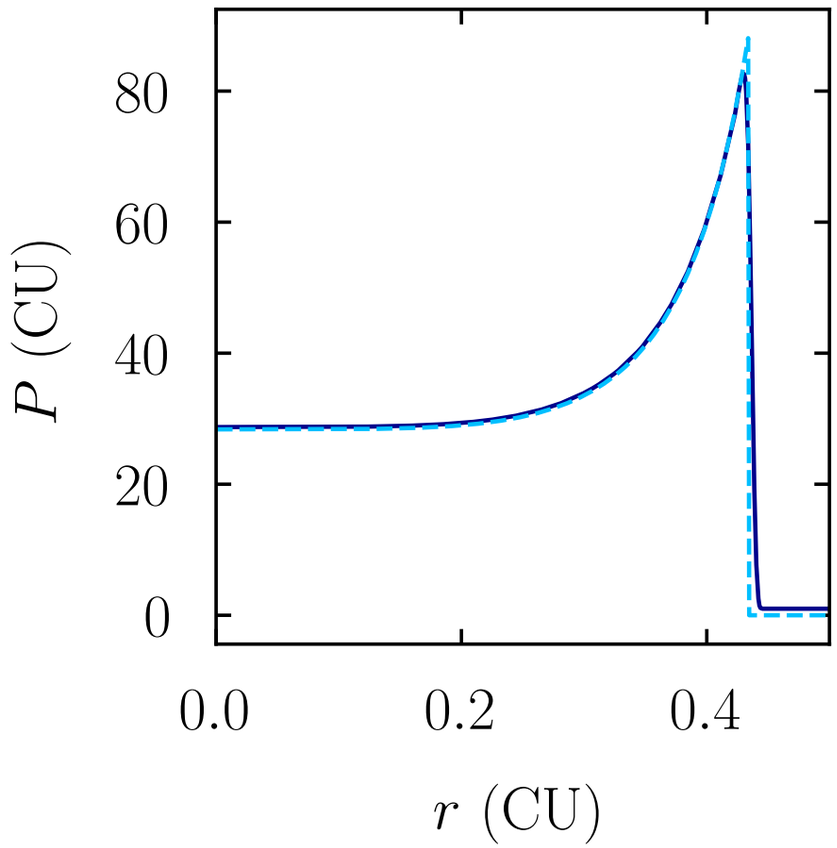
Sedov-Taylor blastwave

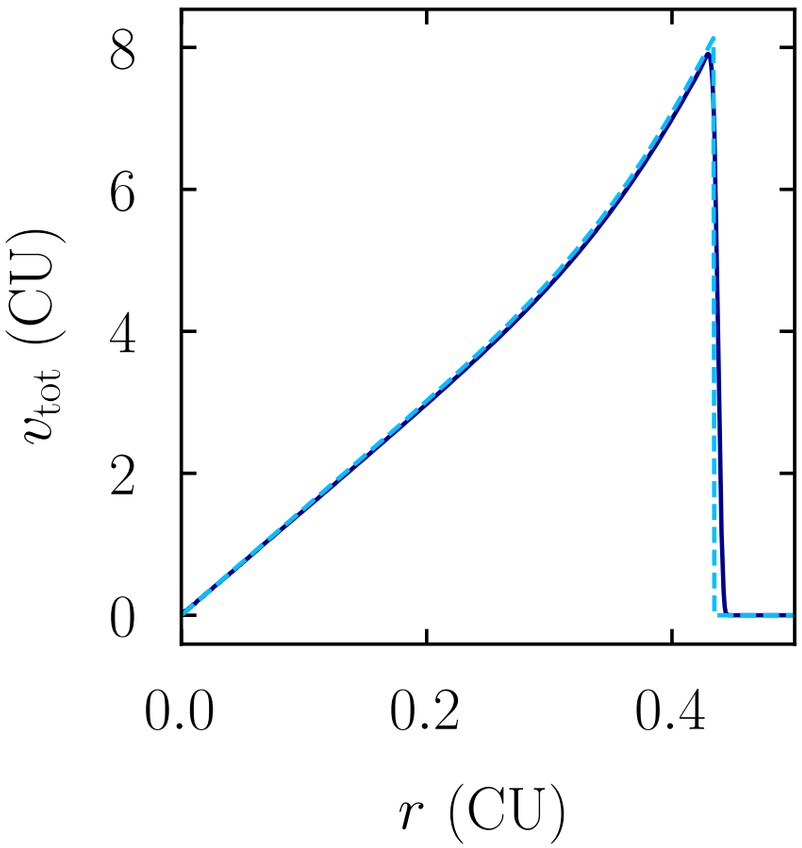


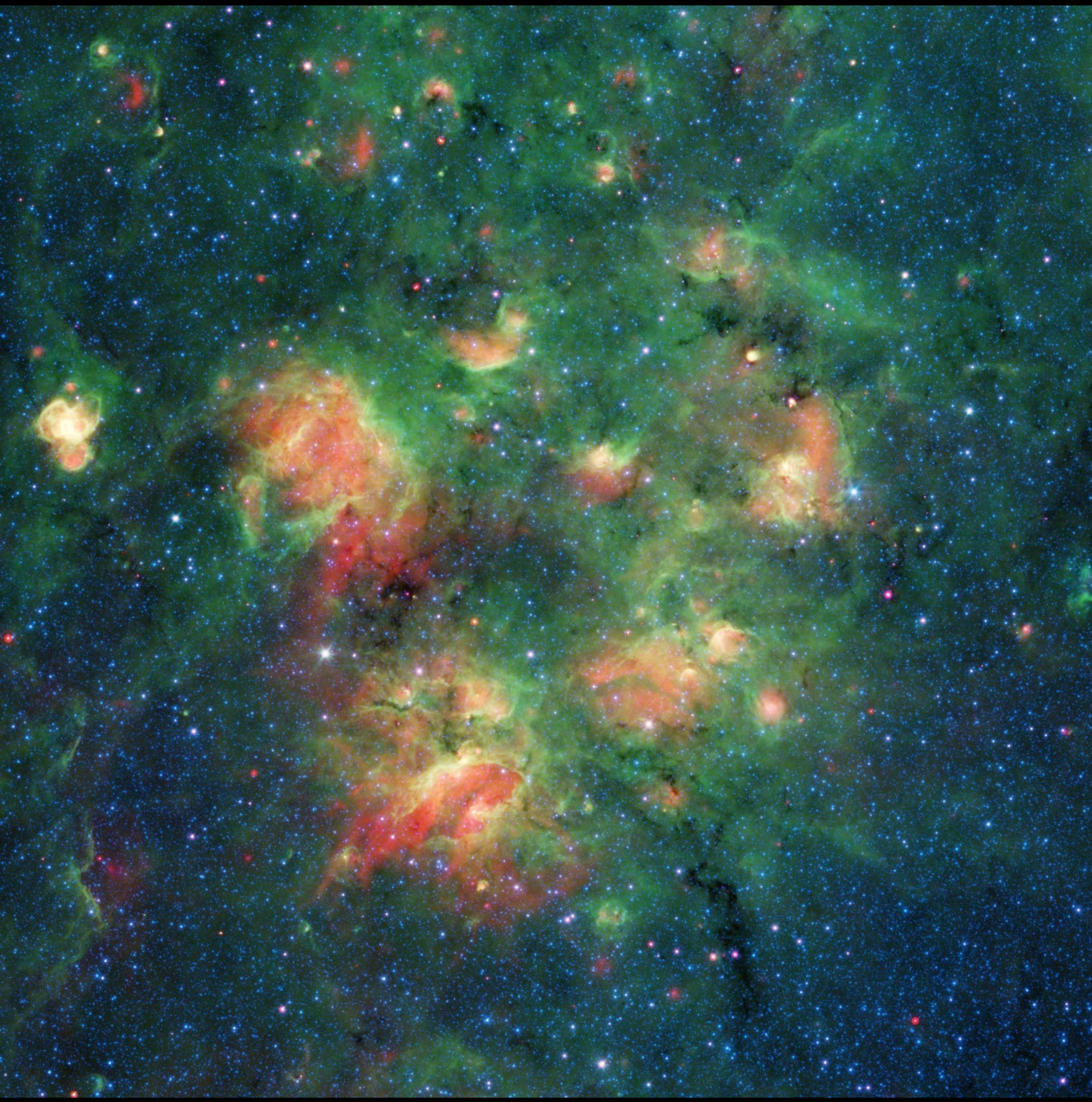
Made with ULULA

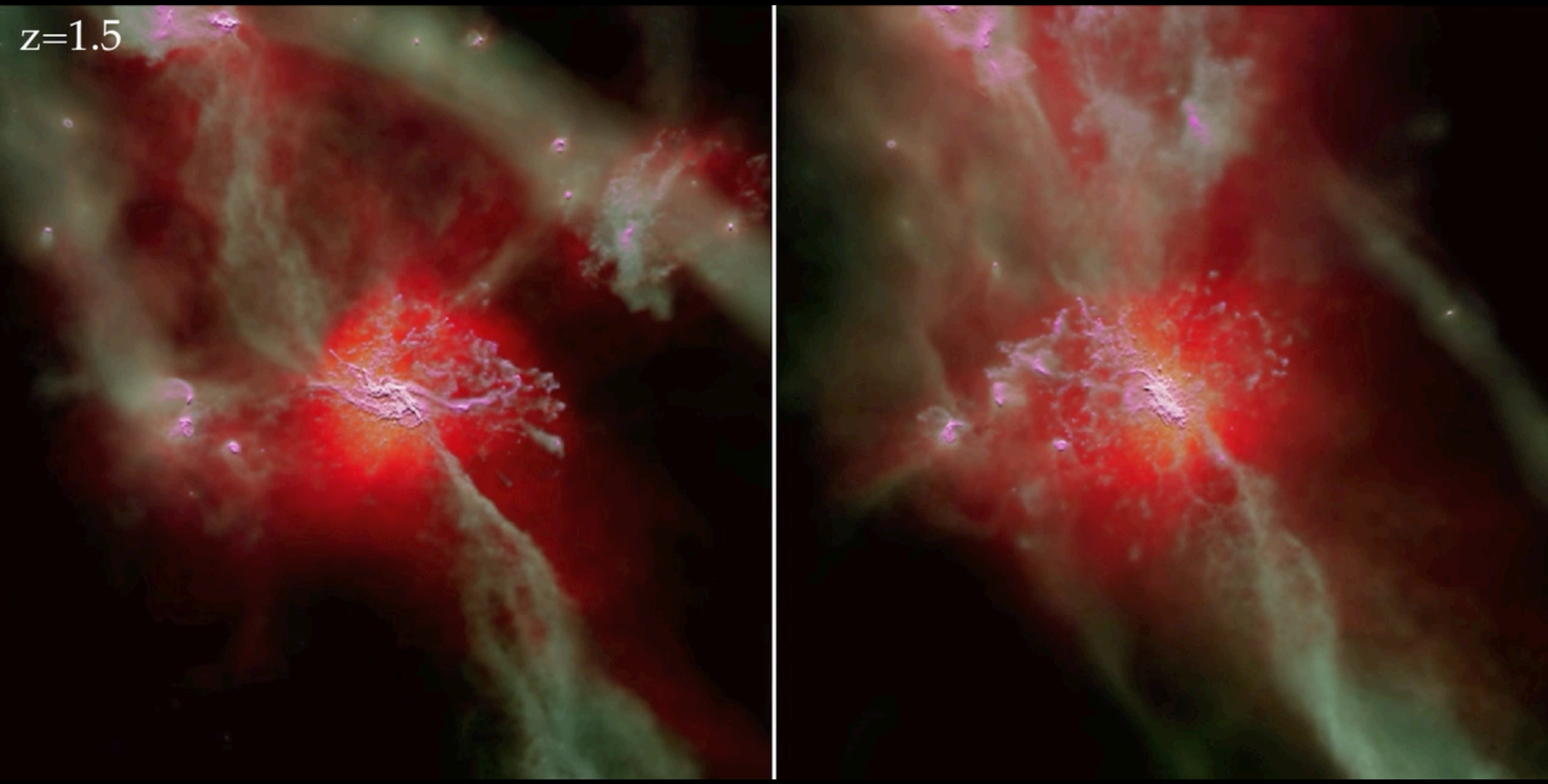
Sedov-Taylor blastwave











FIRE Collaboration (video page)

Reading

- Recommended: CC §7, §8.1-3, Zingale §6.1
- Additional: Shu §15, §16, §17