

Foam Evolution: Experiments and Simulations

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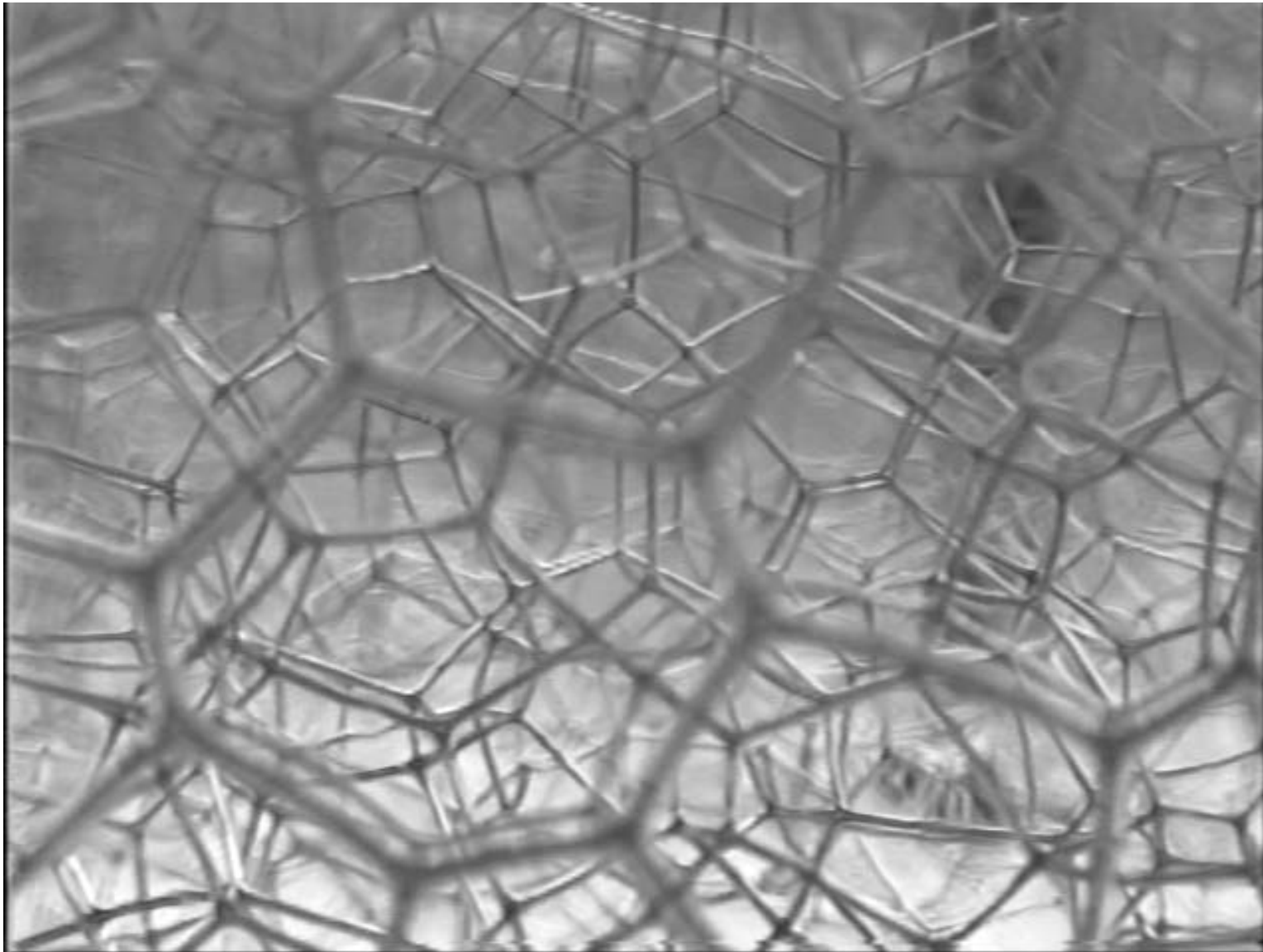
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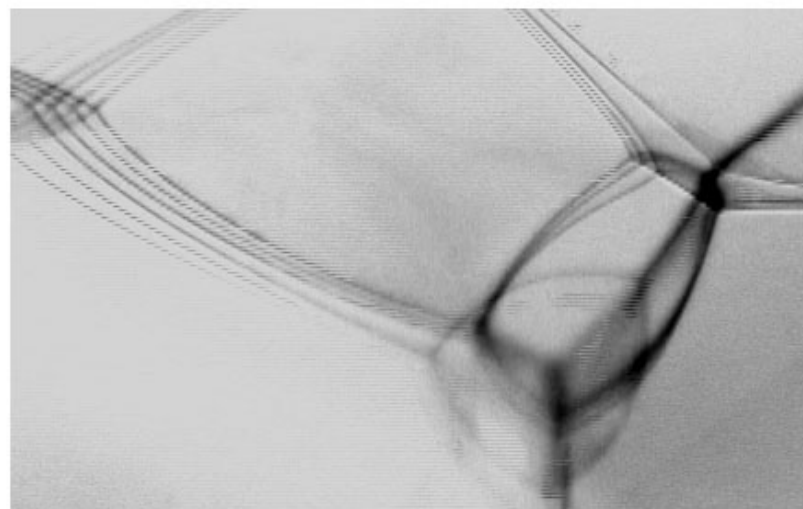
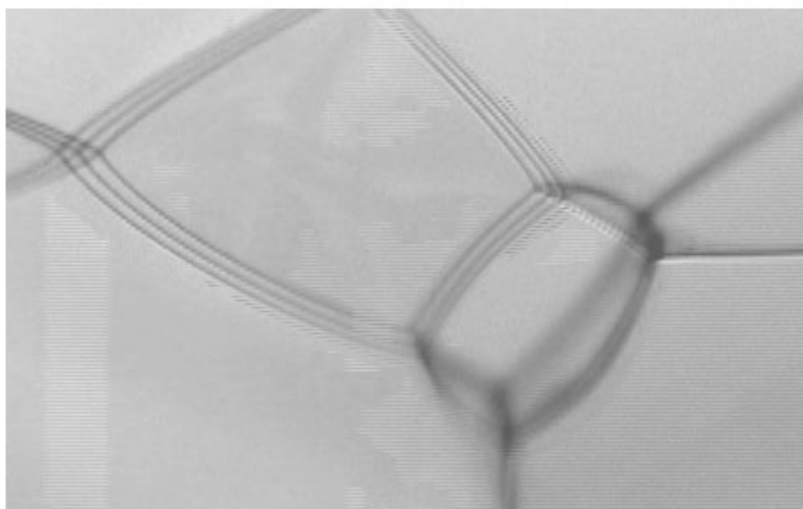
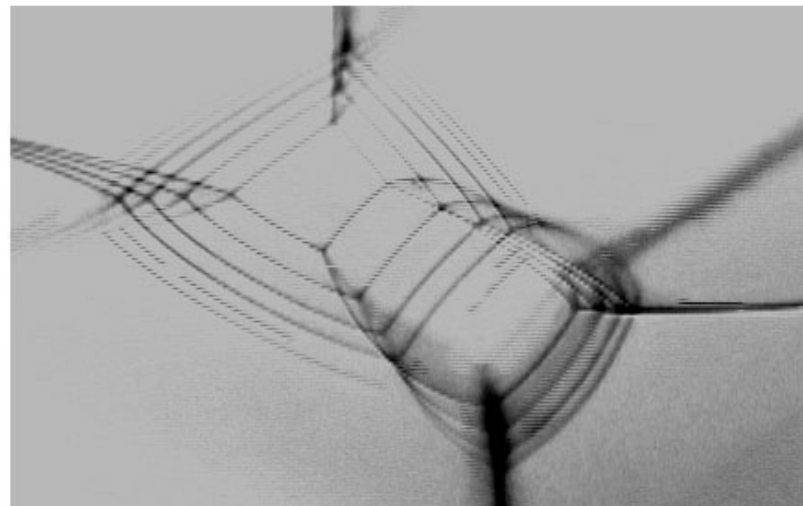
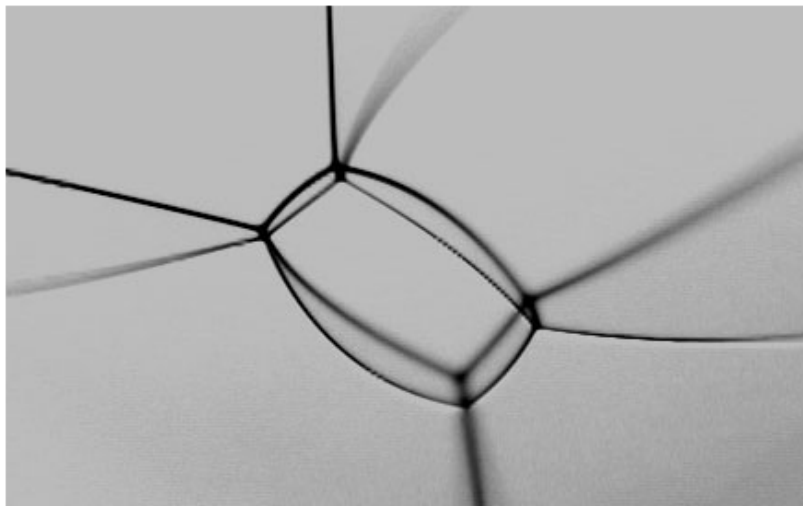
Foam Evolution and Flow:

- Topological reconnections
- Phase transitions
- Visual-light tomography
- Numerical simulations
- New TCP structures

Reconnections:

- Foams evolve (diffusion, etc) at slow time scales
- When nodes meet, Plateau rules are violated
- New films and borders appear, and expand to equilibrium
- Reconnections happen over time scales less than 100ms



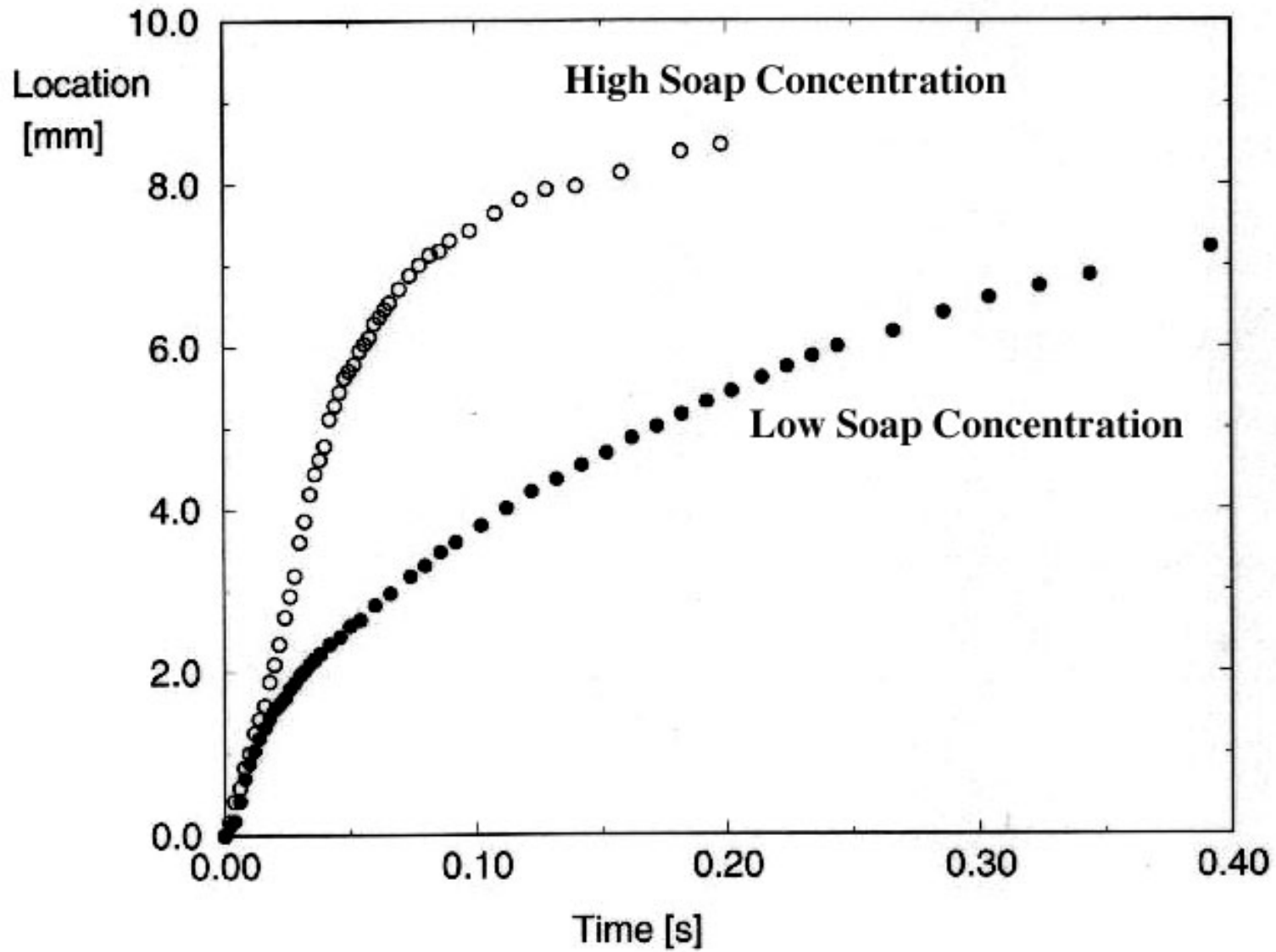


Experiments:

- High-speed video camera
- Coarsening foams & adjustable wire-frame
- Avalanches of reconnections

Dynamical model:

- Incorporates Marangoni effects
- Adjusted to fit experiments

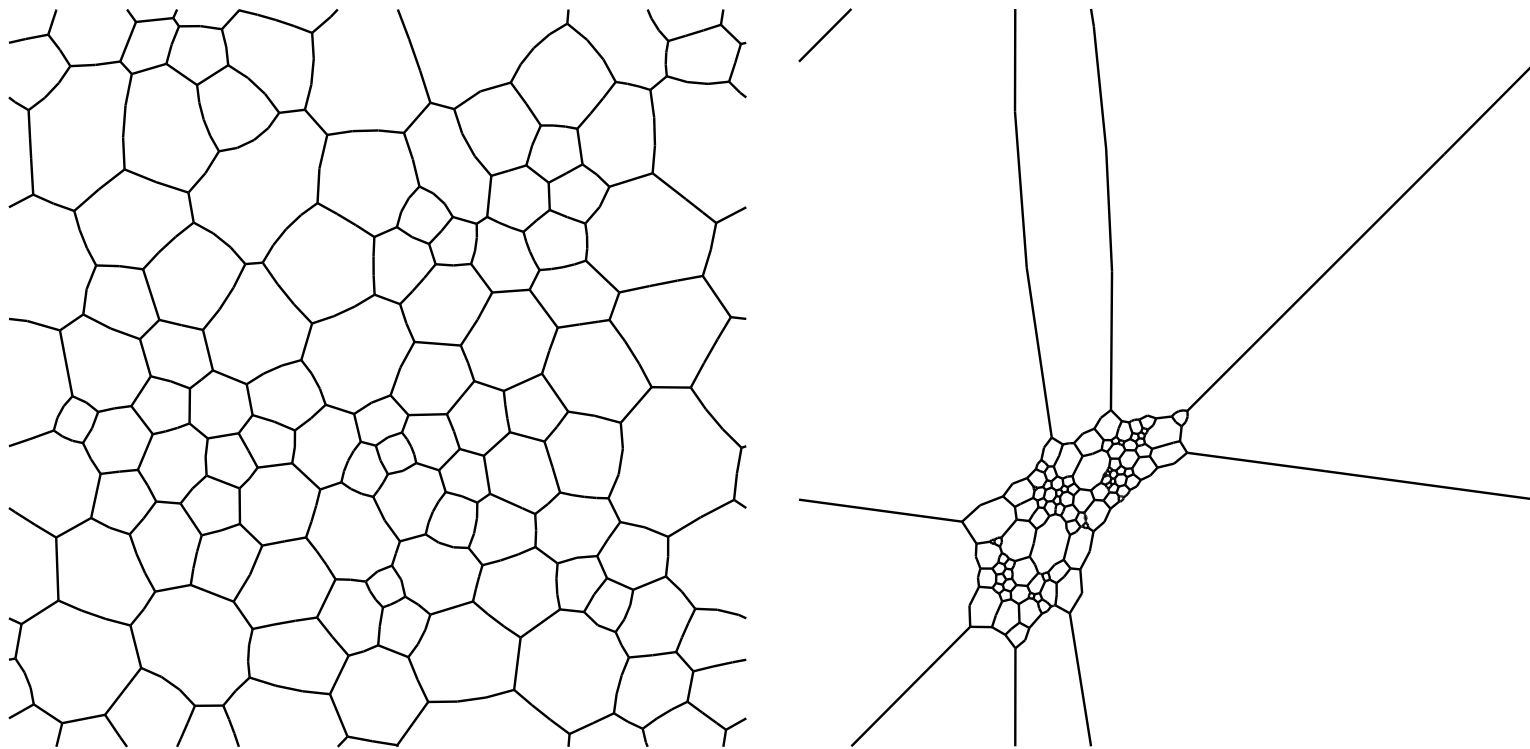


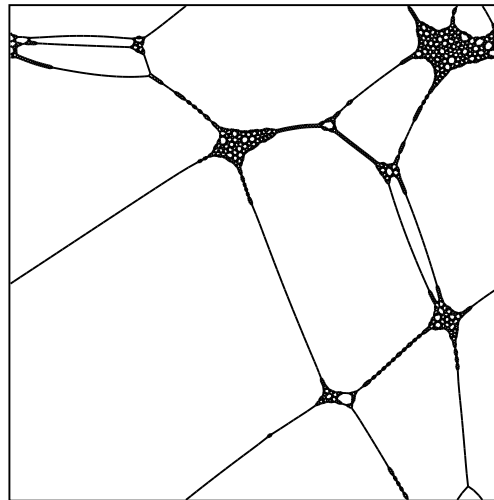
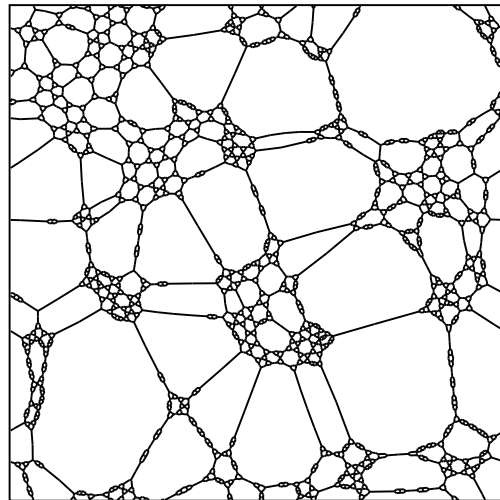
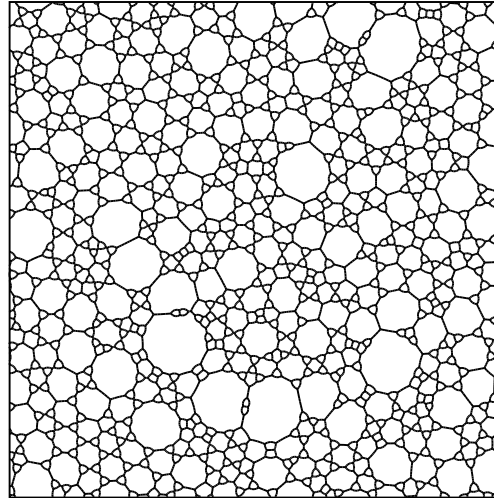
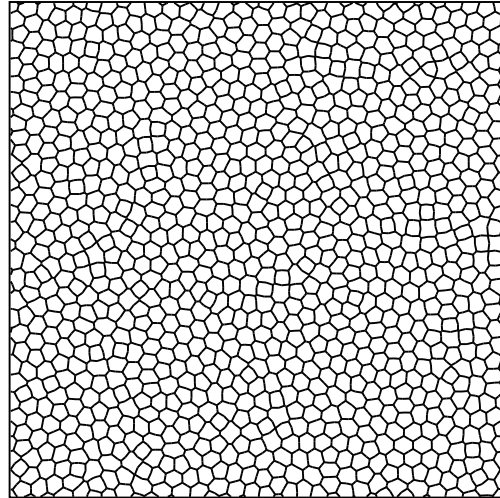
Negative Ambient Pressure:

- gas very compressible
- surface tension high
- foam pulls inwards on container

Phase Transition:

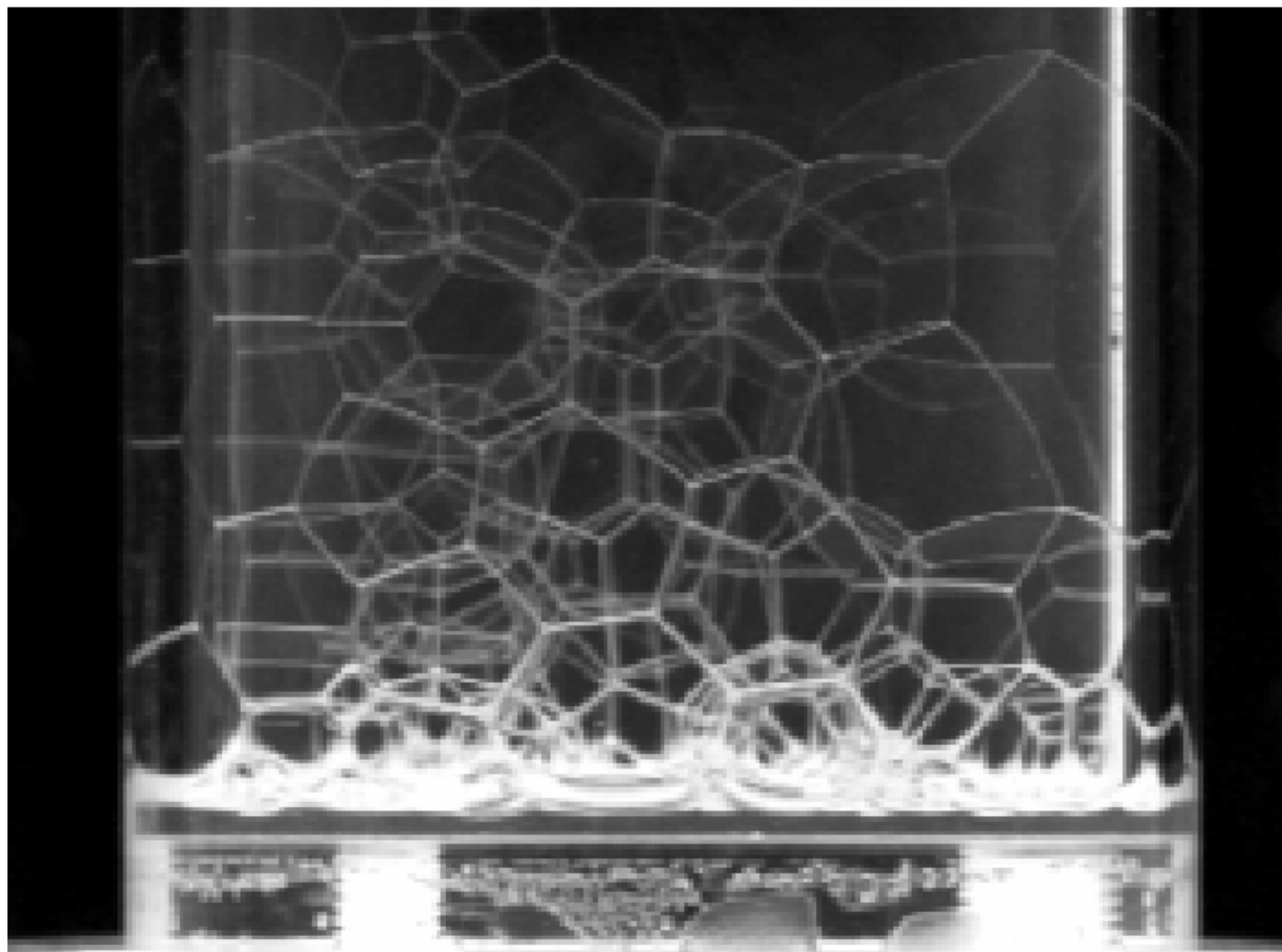
- Bubbles separate into two phases
- Few huge bubbles at low pressure
- Many small bubbles at high pressure
- Theory agrees with numerical simulations

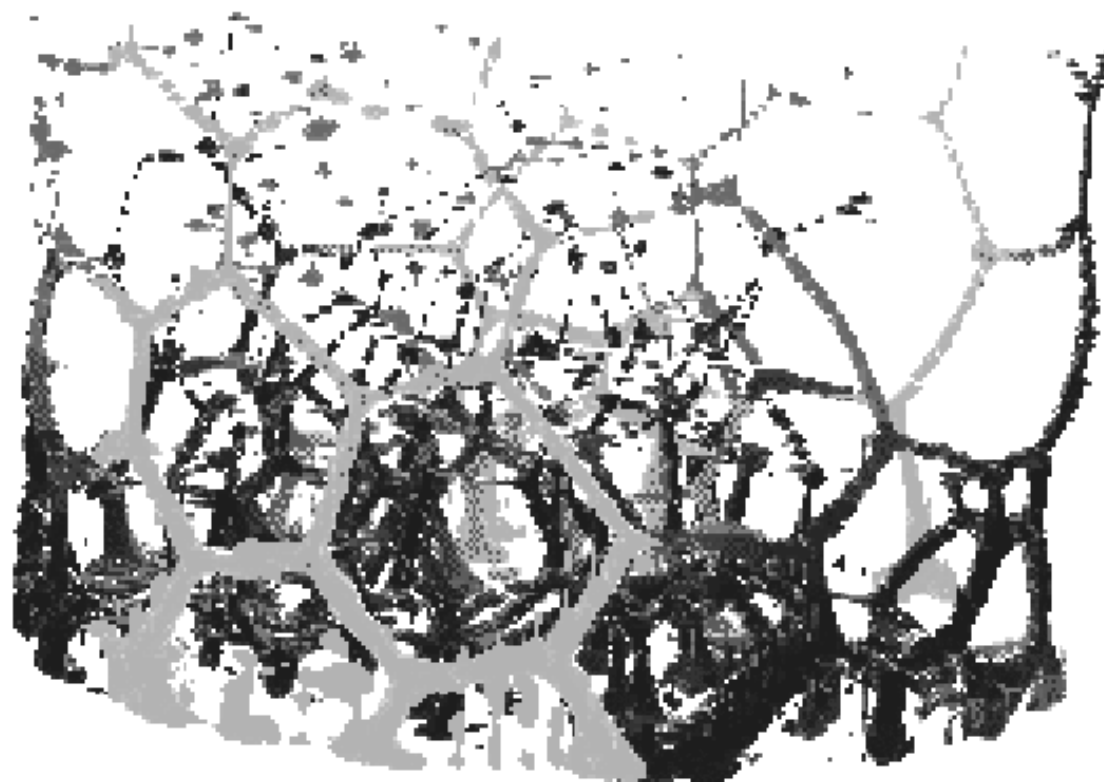




Experimental setup:

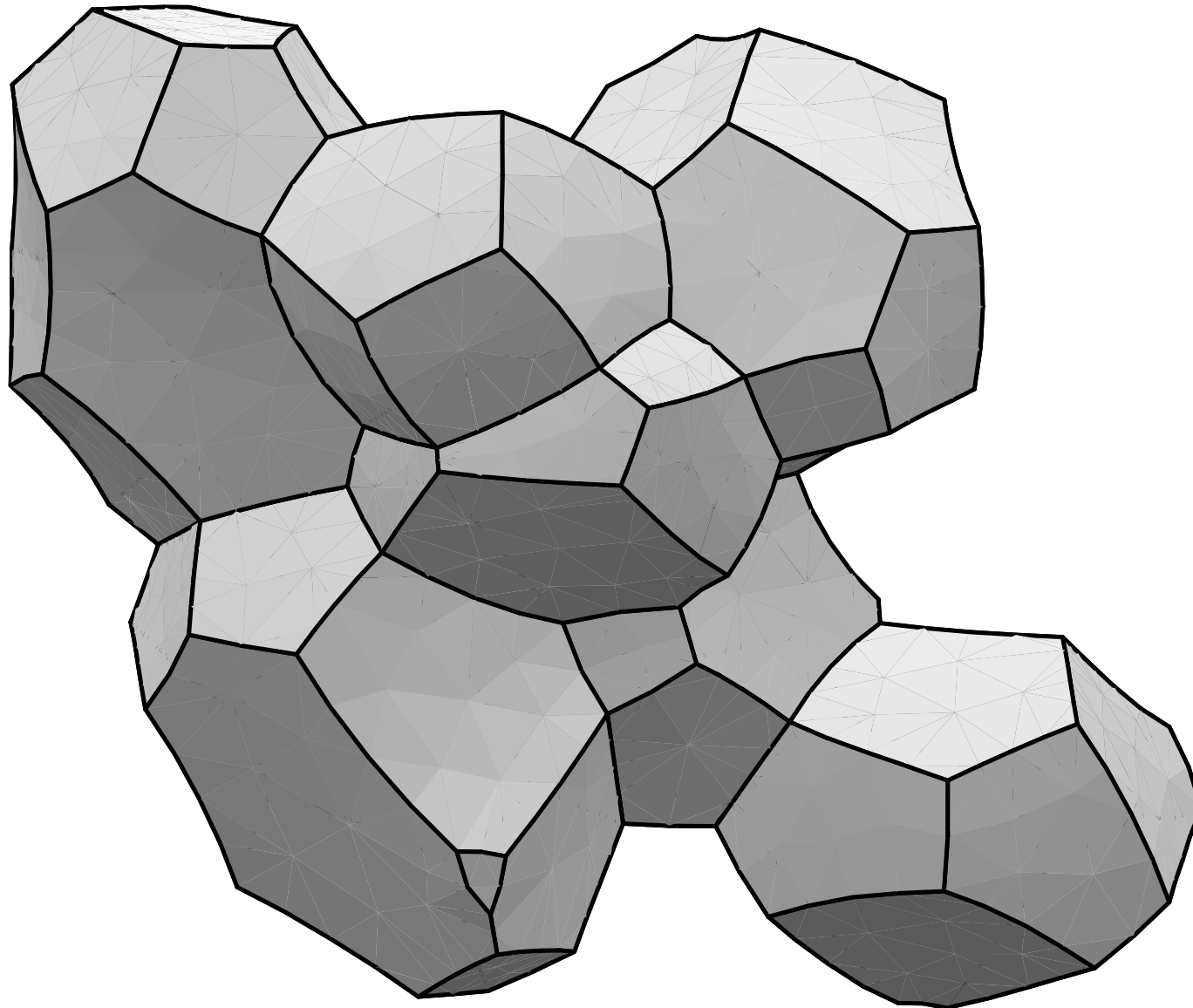
- Cone-beam tomography
- Visible light
- Rotating foam in cylindrical container
- Correction for lensing effect





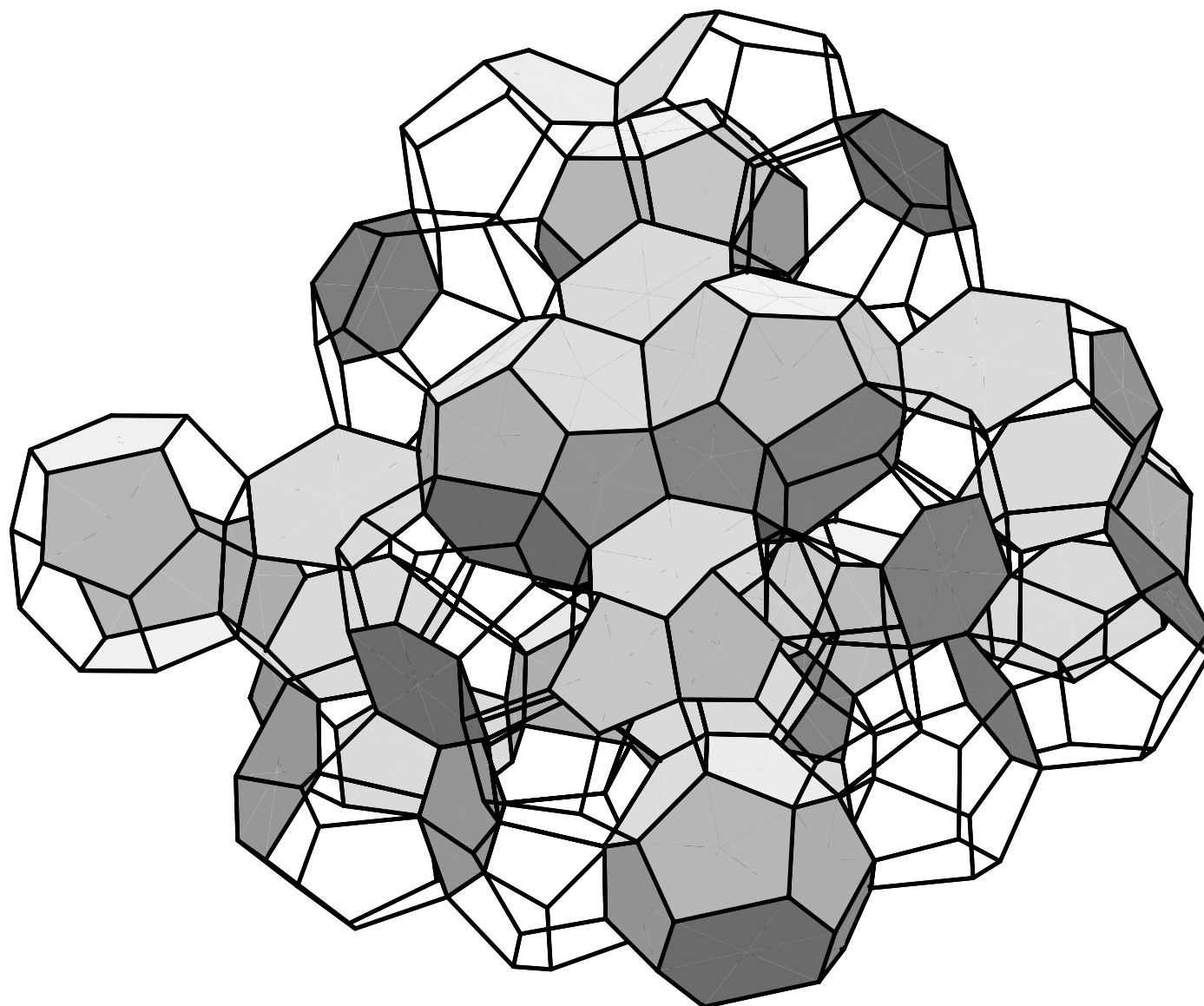
Surface Evolver:

- Diffusion in 2d
- Varying surface tension in 2d
- Extensions to 3d



TCP structures:

- Large family of monodisperse foams
- Semi-random structures
- Mathematical interest



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Sullivan, “New Tetrahedrally Close-Packed Structures”, Proc. Euroconf. on Foams, Delft (June 2000).

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