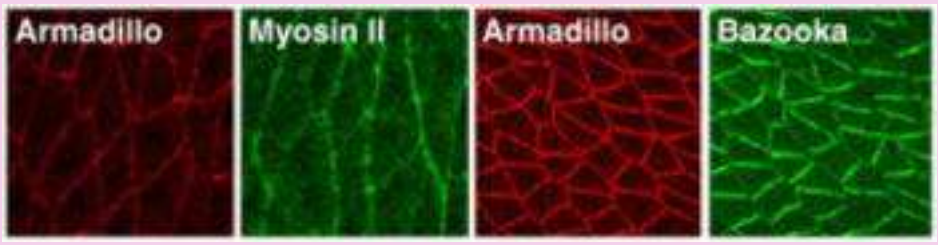
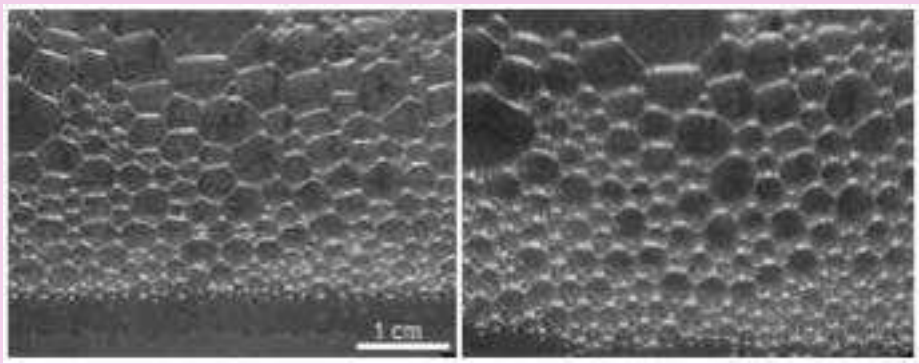
APS MARCH MEETING 2005

- Cell-pattern disordering during convergent extension in Drosophila.
  J. A. Zallen and R. Zallen

- Step Strains in a Disordered Foam.
  M. Twardos and M. Dennin

- Speckle Visibility Spectroscopy and Bubble Rearrangements.
  A.S. Gittings and D. Durian





Convergent extension is the cell rearrangement process by which a developing embryo elongates to establish the head - tail body axis.
p(n) $\rightarrow$ fraction of cells having n sides.
For ordered honeycomb structure p(6) = 1, with increasing disorder distribution broadens and p(6) drops.
3 types of embryos studied : One Wild type, two mutant embryos ‘eve‘ and ‘khft’ Studied from Stage 6 (proir to onset of convergent extension) to stage 8 (time of intercalation).

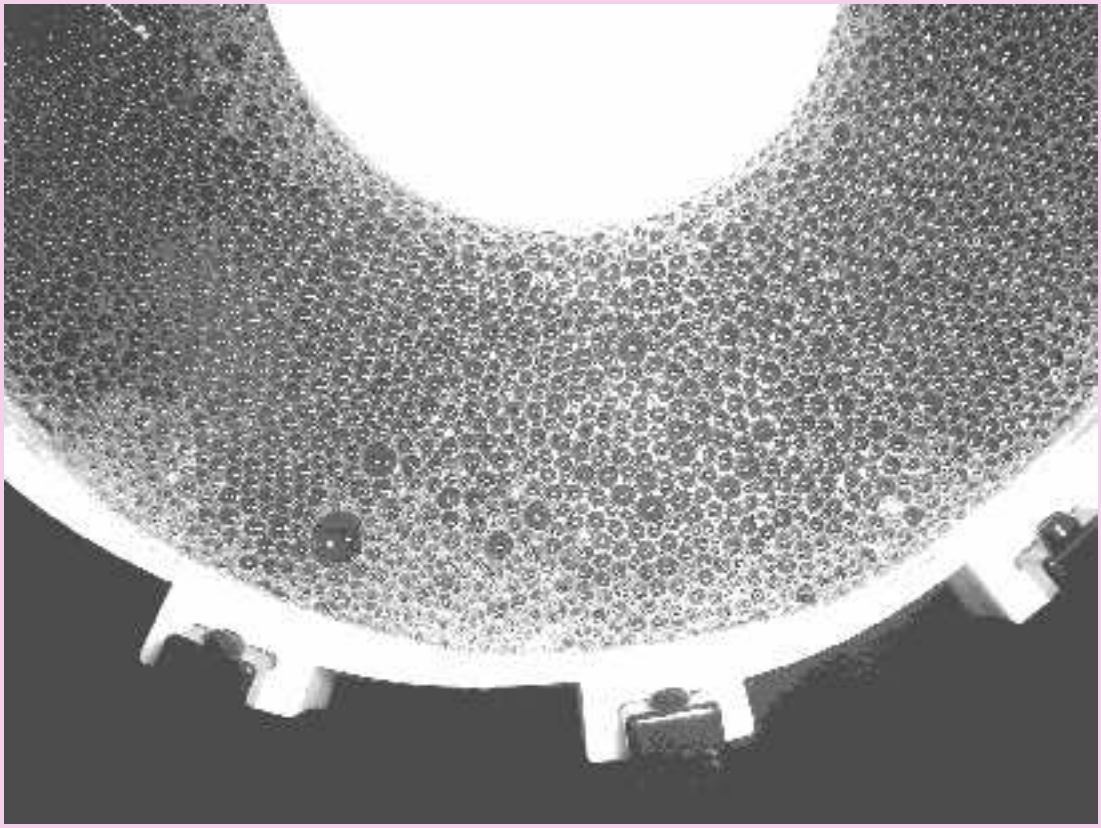
WILD TYPE	EVE MUTANT	KHFT MUTANT
Stage −6	Stage −6	Stage −6
Predominantly p(6)	Predominantly p(6)	Predominantly p(6)
Stage −8	Stage −8	Stage −8
Very little p(6) large number of p(5) and p(7) some p(4) p(8)	Majority p(6) with few p(5) and p(7)	Predominantly p(6)
Variance of Distribution	Variance of Distribution	Variance of Distribution
Large (~ 1)	Small (~0.7)	Very small (~0.3) Same as in Stage − 6

Number of fourfold vertices increase in between Stages 6-8. Result of large number of T1 processes.

Step Strains in a Disordered Foam.

M. Twardos and M. Dennin

Objective : Was to compare stress relaxations for an applied step strain and during a slow, continuous strain on a bubble raft.



Quasistatic limit Expts and simulations where the properties of the system are independent of the strain rate for small strain rates (Eg. Bubble model).

The distribution of stress drops have a well defined average value, indicating no evidence for a diverging lengthscale for the small strain rates.

Quasistatic simualtions Simulations where a small strain is applied and the system allowed to relax to a local energy minimum before the next step strain is applied.

Suggests that a diverging lengthscale does exist.

Is there a fundamental difference between quasistatic step strains and constant rate of strain ?

OR

Is the difference in results simply a manifestations of differing definitions of stress drops ?

Step strain measurements : Total angular displacemnet applied in a step and divided by the time it took to strain it, in addition to the time allowed for relaxation.

Results:

- For long waiting times, the overall shape of the probability distribution of the stress drop as a function of stress drop is roughly the same.

- Continuous strain case has significantly more small stress drops.

- For continuous case average stress drop decreases with decreasing rotation rate; for step strain case average stress drop *increases* with decreasing rotation rate.

- No system size dependance.

Conclusions:

Definition does account for some of the differences, their results also suggest some fundamental difference between the step strain and continuous strain. Also they obtain a typical timescale of $10sec$; beyond this *"waiting time"* the measurements become independant of waiting time. A similar timescale is also observed for continuous cases.

What is Speckle Visible Spectroscopy ?

- New Dynamic Light Scattering (DLS) method.
- Capable of resolving motion that changes systematically and rapidly with time.
- Based on the visibility of a speckle pattern for a given exposure of time.
- First used by Dixon and Durian to study a vibrated layer of glass beads.
- Here they use it to study bubble re-arrangements in aqueous foam.

The foam sample is contained within a thick glass cell, one face of which is entirely covered with absorbing black tape.

Laser light is both introduced and collected at a 1-mm diameter hole punched in the tape. (Nd-YAG laser $\lambda = 532nm$). Photons moving through the bubbles exhibit a random walk and are backscattered after a few events. The backscattered light forms a speckle pattern in the far field which they detect using a digital line scan CCD camera.

The random walk by which the photons diffuse depend on the wetness of the foam. (Shown previously by the same authors) Steps longer in gas and shorter in liquids. Most of the light scattering is at the Plateau borders.

As the bubbles rearrange the pattern changes. Intensity fluctuations occur at each pixel. They study the variance of intensity across pixels.

For the pattern to be visible, exposure time of the CCD has to be shorter than the time scale of speckle fluctuation. Otherwise pattern will be a blur.

Bubble rearrangement velocity is determined from the variance of intensity across pixels vs. exposure time.

Gas diffusion from smaller to larger bubbles increase the transmitted intensity. So coarsening of foam can also be studied using this technique.

The Geometric Cluster Algorithm: Rejection-Free Monte Carlo Simulation of Complex fluids.

Erik Luijten