# Foam as granular matter

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**Section 2 – Project Details**

**Project Description:**

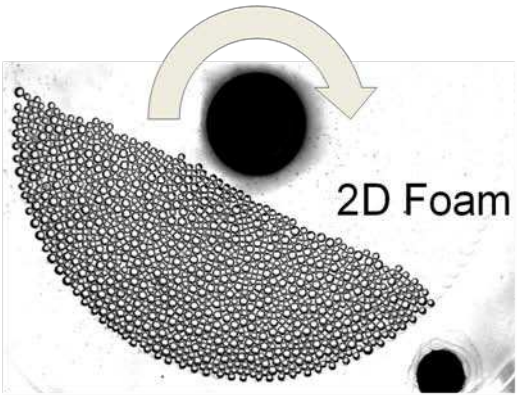
Foams as granular matter

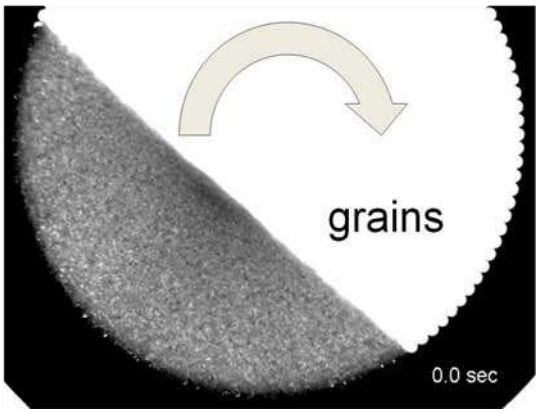
Granular matter and foams are examples of complex fluids whose flow properties differ greatly from ordinary Newtonian liquids such as water. Both media can be thought of as a system of densely packed spheres. In the granular case, the spheres are frictional macroscopic particles, while foam consists of much softer, deformable air bubbles dispersed in a liquid phase.

Despite these differences, they both show strikingly similar behaviour under external forcing [1]: Both “fluids” have a so-called yield stress – the stress below which there is no flow. This is why sand piles do not flatten out but stay put at a certain angle – the angle of repose.

Also, their flow is extremely localized at the shearing wall. Are these similarities coincidence or do they point to a deeper connection?

In this mostly experimental project you can explore the flow of micro-bubbles in a rotating drum (see picture). Will the bubbles dilate under shear just as grains do? What will happen if you stop the rotation – is there a finite angle of repose? Will the bubble size separate similar to grains?




Left picture: Micro-bubbles in a rotating drum. Right picture: Granular media being sheared in the same setup.

These questions are important since foams, grains and many other complex fluids become increasingly important in a wide variety of industries such as foods, oil recovery and pharmaceutics, for example. There is still no theoretical model that captures the rich phenomenology of these materials entirely.

This is mainly an experimental project and will help to better understand what flow properties foams share with granular media. What are their differences?

By studying a two-dimensional foam in a rotating drum, you can record the bubble motion while the system is sheared and use image processing software such as IDL to analyse the data.

The goal is to study the flow of the foams and investigate if any granular phenomenology is present such as shear dilatancy, angle of repose and size separation. The people from the Foams and Complex systems group will actively support you during your stay.

1] , D. Weaire, V. Langlois, M. Saadatfar, S. Hutzler, “Foam as granular matter”, Granular and Complex Materials, World Scientific Lecture Notes in Complex Systems (eds. Aste T, Di Matteo T and Tordesillas A), 8, 1-26