CLUSTER COARSENING IN ELECTROSTATIC GRANULAR CELLS

OUTLINE:
• THEORETICAL BACKGROUND.
• MOTIVATION.
• EXPERIMENTAL SETUP.
• OBTAINED DATA.
• DISCUSSION OF THE RESULTS.

WORK MADE BY:
• RAJ GUPTA
• ROI RODRIGUEZ
• IKER ZURIGUEL
THEORETICAL BACKGROUND

BASIC REFERENCES:
• IGOR ARONSON LECTURES.
• BARUCH MEERSON LECTURES.

MORE SPECIFIC REFERENCES:
• Sapozhnikov, Aranson and Olafsen.
• Aranson, Blair, Kalatsky, Kwok, Crabtree, Vinokur and Welp.
  Phys Rev Lett 84, 3306 (2000)
• Aranson, Meerson, Sasorov and Vinokur.
THEORETICAL BACKGROUND

EXPERIMENTAL CELL:

Transparent Electrode

\[ f \]

\[ \vec{E} \]

\[ \vec{g} \]
THEORETICAL BACKGROUND

We are interested in time evolution of the number of clusters:

$$\# \text{clusters} \sim 1/T^\beta$$

You can measure the exponent $\beta$ looking at time evolution of 1 single cluster.
THEORETICAL BACKGROUND

With our frequency the typical behaviour for a single cluster is:

\[ A \propto (t_0 - t)^\beta \]

- \( \beta = 1 \) for big clusters
- \( \beta = \frac{2}{3} \) for small clusters

In the controlled electric field:

- \( \beta = 1 \) for high frequency
- \( \beta = \frac{2}{3} \) for low frequency and DC
MOTIVATION

• THEORY CHECKED IN A VERY EXPENSIVE EXPERIMENTAL SETUP.
  • HIGH FRAME RATE CAMERA.
  • SMALLER PARTICLES.
  • CONTROLLED ATMOSPHERE...

THIS EXPERIMENTAL SETUP SHOWS A TIME DEPENDENCE:

$$A = (t_0 - t)^{2/3}$$

FOR SMALL CLUSTERS
**MOTIVATION**

- **BUT IGOR HAVE A “PORTABLE CELL” EXPERIMENT.**
  - **BIGGER PARTICLES.**
  - **WE DO NOT CONTROL THE PARAMETERS.**
  - ...
MOTIVATION

• IN THIS “PORTABLE CELL” HAS NOT BEEN TESTED BEFORE.
  • WE HAVE A LOW FRAME RATE CAMERA.
  • BAD CONDITIONS.
  • ... BUT NOT COMPLICATED MEASUREMENTS TO DO. ONLY THE EVAPORATION TIME OF SMALL CLUSTERS.

WE HAD TO MAKE THE MEASUREMENTS:
• PORTABLE CELL
• COMPUTER
• DIGITAL CAMERA
• SCREWDRIVER
• TABLES
• CHAIRS ...
EXPERIMENTAL SETUP

- Complex data acquisition system
- Complex experimental system
- Interface between experiment and data acquisition system
- Overhead projector
- Table
- Chair
- Computer
- Paper Box
- Digital Camera
OBTAINED DATA
OBTAINED DATA
OBTAINED DATA
OBTAINED DATA

THE EXPLANATION OF THIS TWO BEHAVIOURS UNDERLIE IN THE SHAPE OF THE CLUSTER:

- **SMALL CLUSTERS: HEAPLET** (MONOLAYER)
- **BIG CLUSTERS: TRAPEZOID** (MULTILAYER)
Obtained data

We take the last 4 seconds of time evolution of every cluster, and fit to a power law expression:

\[ S = A_0 (A_1 - t)^{A_2} \]

\[ A_2 = 0.68 \pm 0.05 \quad \rightarrow \quad 7\% \]

\[ 2/3 = 0.66\ldots \]
CONCLUSIONS

• VERY ROBUST DATA

• EVEN WITH A BAD DATA-ADQUISITION SYSTEM

• PHYSICS CAN BE DONE ALSO WITH A LITTLE AMOUNT OF MONEY
THE END

THANKS TO ALL FOR THIS NICE TIME HERE

THIS IS NOT POWERPOINT

THIS IS NOT LATEX