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1 test 1

1.1 test 2

1.1.1 test 3

- test 4

2 Melting A

2.1 Background re: melting

2.1.1 Theories of melting, 3D, 2D, bulk

- 3D crystallites w/ stable surfaces melt from within via Born melting
In this case, melting can be viewed as nucleation and growth of fluid phase within the solid.
- 2D large crystallites melt by two-step process via hexatic phase
- 2D finite crystallites melt from perimeter
 - if melt from perimeter, dN/dt goes as $N^{1/2}$

2.1.2 Expectations for 2D finite crystallites

2.2 Experiment of Savage et. al

2.2.1 Setup

2.2.2 Tunable Depletion potential

2.2.3 Results

- N vs. t
- $\langle \psi_6 \rangle^2$ vs. N
- C_6 vs. N , by layer
- No dependence of fast-melting feature on initial cluster size or melting rate

2.3 Simulations

2.3.1 Motivation

2.3.2 GROMACS System

2.3.3 Brownian dynamics

2.3.4 Simulated Depletion Potential

2.3.5 Simulated Lennard-Jones Potential

2.3.6 Results

- N vs. t
- $\langle \psi_6 \rangle^2$ vs. N
- C_6 vs. N , by layer
- mean-square fluctuations in bond lengths
- N vs. t for Lennard-Jones potential
- Phase diagram showing lack of fluid phase with short-range potential

2.3.7 Discussion

3 Melting B

3.1 Background

3.1.1 Hypothesis: thermally-activated defects enhance melting rate in short-range 2D system

3.2 Simulation Methods

3.2.1 Gromacs system

3.2.2 Brownian Dynamics

3.2.3 Characteristics of Simulated Depletion Potential

3.2.4 Initial configurations

3.3 Results

3.3.1 N vs t

3.3.2 Order vs. N

3.3.3 Breakdown by layers

3.4 Conclusions

4 Diameter of Random Clusters

4.1 Background

4.2 Simulations

4.3 Results

5 Phase Transitions in Computational Complexity

5.1 Background

5.1.1 Constraint Satisfaction Problems (CSP)

- Examples
 - kSAT
 - Graph-coloring

- Spin models
- error-correcting codes
- Observation of threshold behavior in CSP
- Difficulties in tackling phase behavior of CSP

5.1.2 Proposal: study complexity of percolation model

5.2 Percolation

5.2.1 The Model

5.2.2 Background / applications

5.3 PRAM

5.3.1 Applications in comp sci

5.3.2 PRIORITY CRCW

5.4 Parallel Algorithm for Percolation

5.5 Results

5.5.1 D_2 vs. p for several system sizes L

5.5.2 $\log(D_2)$ vs. $\log(L)$

5.5.3 Distribution of cluster sizes

- logarithmic or power law? (power law \Rightarrow algorithm will often fail)