Chapter 6. Graphoepitaxy of Colloidal Crystals

Sponsors

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6.1 Structure of Langmuir-Blodgett Films

Project Staff

Brian McClain, Professor J. David Litster

In this portion of the project, we are using surface sensitive x-ray scattering techniques to study the structure of Langmuir-Blodgett films which, when pulled in the standard way, form monolayers on the surface of water. Langmuir-Blodgett films have the potential for applications as in dialectrics devices; these films can also serve as model systems for studying the structure of two-dimensional materials.

During the past year, we designed and built a spectrometer for glancing-angle x-ray scattering from the surface of liquids. Testing of the spectrometer on a 12 kW rotating anode source is currently underway in preparation for use at the National Synchrotron Light Source storage ring. We will study the structure of the Langmuir film precursors from which L-B films are drawn.

This work will be continuing with support from the National Science Foundation.

6.2 Growth of Colloidal Crystals

Project Staff

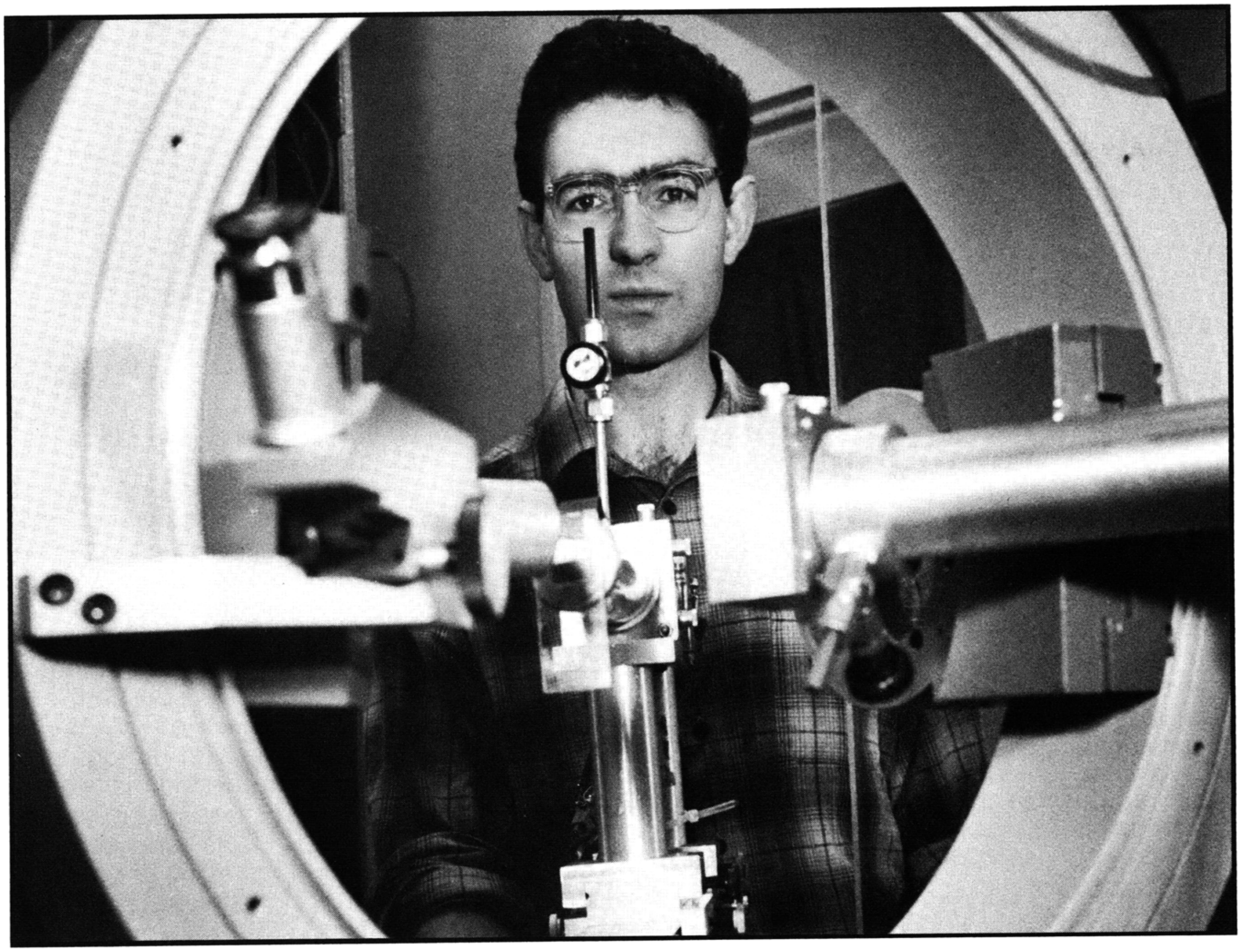
Ronald Francis, Professor J. David Litster

Our goal in this portion of the project is to use colloidal crystals of polystyrene latex spheres as models for studying epitaxial-growth on patterned substrates. We are using a thin cell in which the ionic strength of the colloid can be reduced to the point where crystallization occurs. We can control the texture and patterns of the substrate precisely on the "atomic" scale of the model systems (about 0.1 μm) with lithographic techniques. We obtained the thermal diffuse intensity by integrating inelastically scattered light over frequency. Data are currently being analyzed using theoretical models for the x-ray structure in finite-sized two-dimensional systems.

Light scattering techniques have several advantages over x-rays because we can also obtain dynamic information from the process. Also, light scattering techniques have excellent energy resolution and cleanly separate elastic (Bragg) scattering from inelastic (thermal diffuse) scattering.

We may also use this technique to quantitatively study the dynamics of the "atomic" motion in the colloidal crystal.

This work will be continuing without outside funding.



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