Scientists show how some solids mimic liquids on nanoscale

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A University of Waterloo physics and astronomy research team, in a paper to be published Friday in *Science Magazine*, shows how some solids behave like liquids on the nanoscale.

The UW researchers, professor James Forrest and then-graduate student Zahra Fakhraai, take a major step forward in discovering how to measure polymer substances using nanoscale technology.

They explore the properties of the large class of natural and synthetic materials on the nanoscale. Their work, appearing in the Feb. 1 issue of the prestigious international journal of original research, is entitled *Measuring the Surface Dynamics of Glassy Polymers*.

Nanoscale technology involves techniques used to manipulate matter at the scale of atoms and molecules. A nanometre (nm) equals one billionth of a metre. In comparison, one human hair is about 80,000 nm thick.

"We are examining the question of what are the properties of materials on the nanoscale," says Forrest, an expert on the physics of soft materials and polymer thin films. "As technology pushes further and further into the nano domain, this question becomes increasingly important."

In other words, scientists know the bulk properties of materials, such as gold or polystyrene (a strong plastic used to make Styrofoam). But it does not mean that if they measure a nanometre-sized sample, or examine with a technique capable of nanometre resolution, they will see

the same thing.

The UW paper explores the first few nanometres of a polystyrene surface. The researchers have developed a technique to look at the dynamical properties of this near surface region with nanometre resolution.

They found that even when the bulk of the material becomes solid, the surface behaves essentially liquid-like. This discovery has huge implications in polymer processing or in any application (such as nanolithography), where very thin polymer films are used.

"The cute thing about the technique is that the actual ideas behind it are almost 500 years old, and even though this has been an outstanding problem and studied in detail for over a decade without resolution, no one had yet thought of this very simple experiment," Forrest says.

Source: University of Waterloo