Chemical & Physical Sciences
UNIVERSITY OF TORONTO
MISSISSAUGA

COLLOQUIUM SEMINAR SERIES

AQUEOUS NANOSCALE INTERFACES: HYDROPHOBICITY AND CONFINEMENT

Water is the most important liquid for life. It is intimately linked to our well-being. Without water, cell membranes cannot function. Charges and charged groups cannot be dissolved, self-assembly cannot occur, and proteins cannot fold. Apart from the intimate link with life, water also shapes the earth and our climate. Our landscape is formed by slow eroding/dissolving processes of rocks in river and sea water; aerosols and rain drops provide a means of transport of water. Because of the complexity of liquid water and aqueous interfaces, the relationship between the unique properties of water and its molecular structure has not been solved. This is especially true for nanoscale interfaces, on which the molecular level structure of water is hard to access. For example, while oil and water do not mix, it is possible to create stable oil nanodroplets in water. These droplets also have a negative charge. Why this is, is a total mystery.

Using a combination of nonlinear optical light scattering and imaging techniques we investigated the water structure in confinement and in contact with purely hydrophobic substances. We find that hydrophobic – water contacts consist of improper hydrogen bonds. Within these bonds the O-H modes of water transfer charge to the oil droplet interface, which explains why oil droplets and other hydrophobic objects in water are negatively charged. These charge transfer interactions are also present in bulk water where they are closely connected to the emergence and disappearance of transient dendritic voids. Confining water within hollow shells of lipids, and using our nonlinear optical methods, we determine what is the longest length scale over which water experiences confinement effects. For H_2O this length scale is as large as 100 nm while for D_2O it is smaller than 20 nm .

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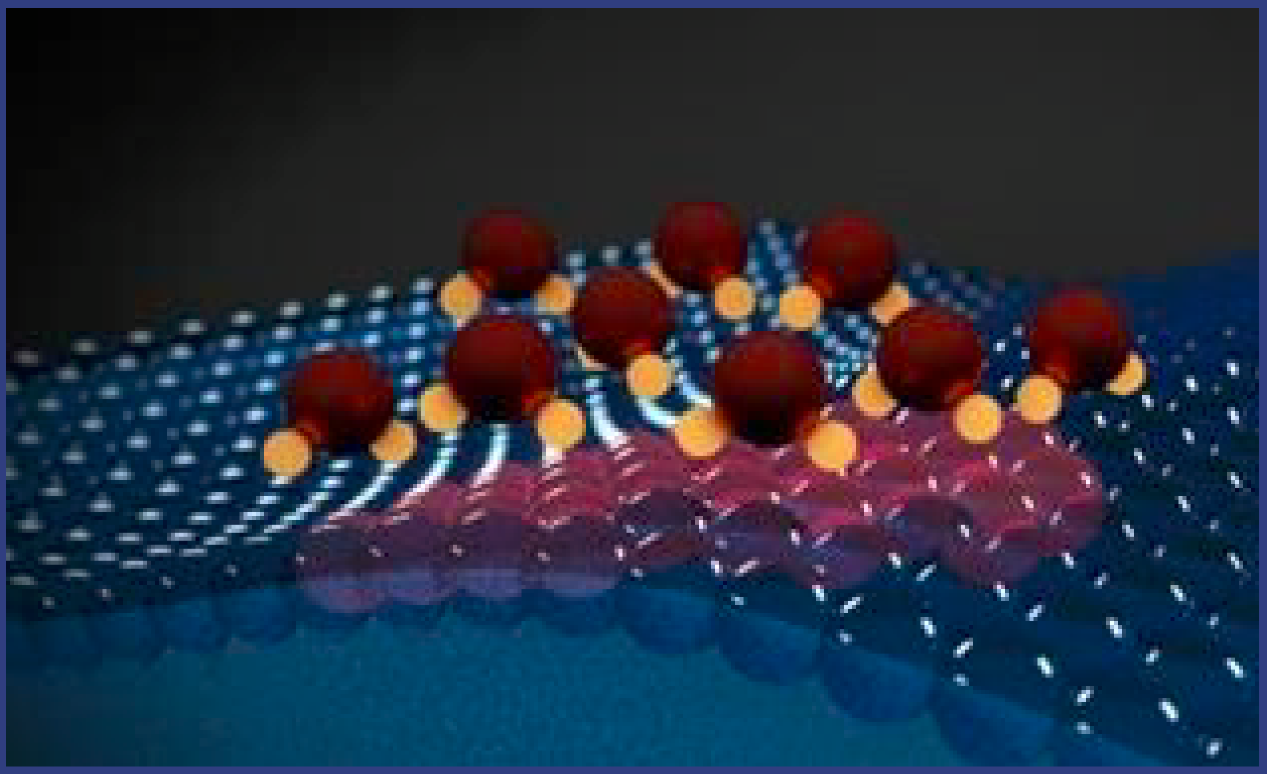

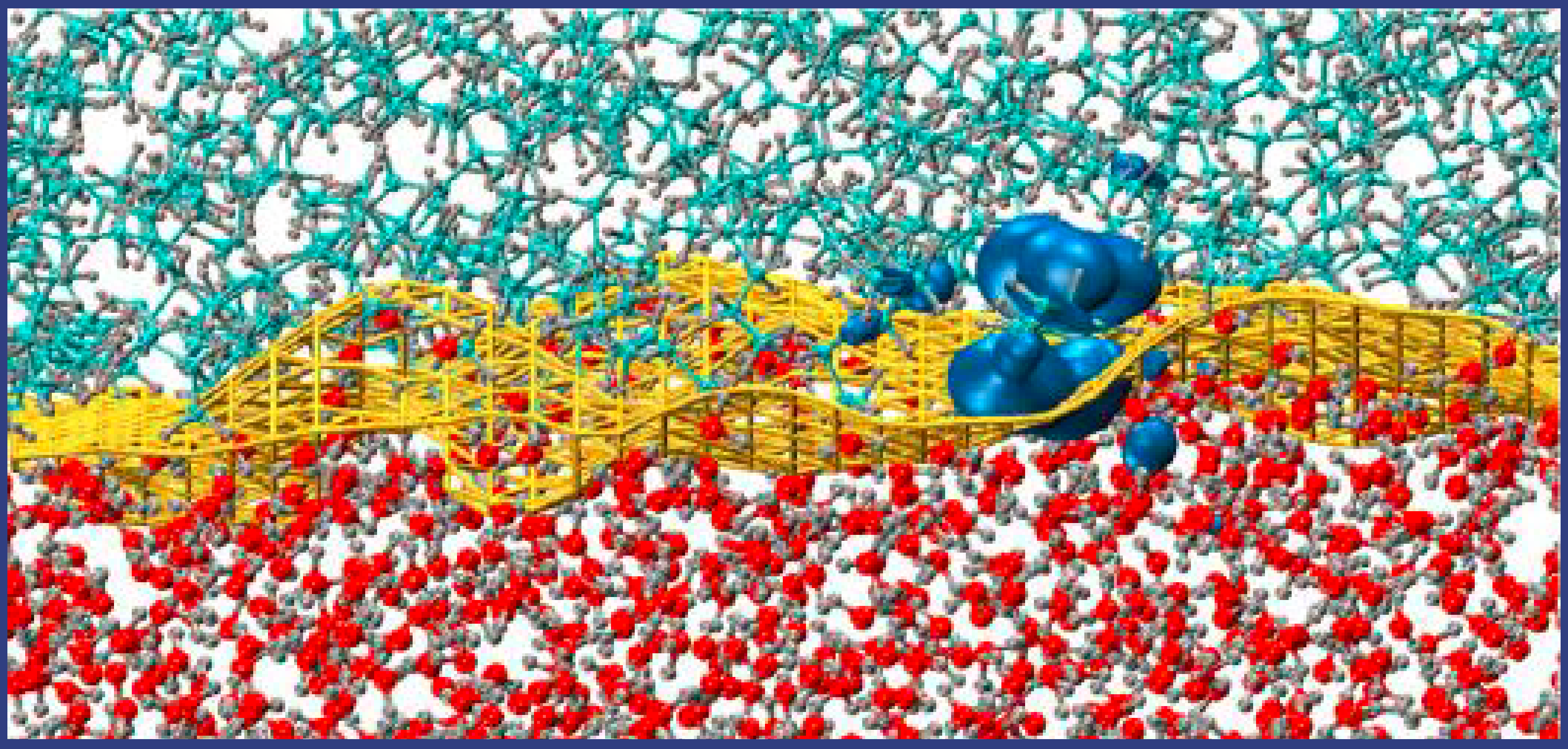

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featuring

Dr. Sylvie Roke

Wednesday, November 9, 2022 | 3:10pm

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