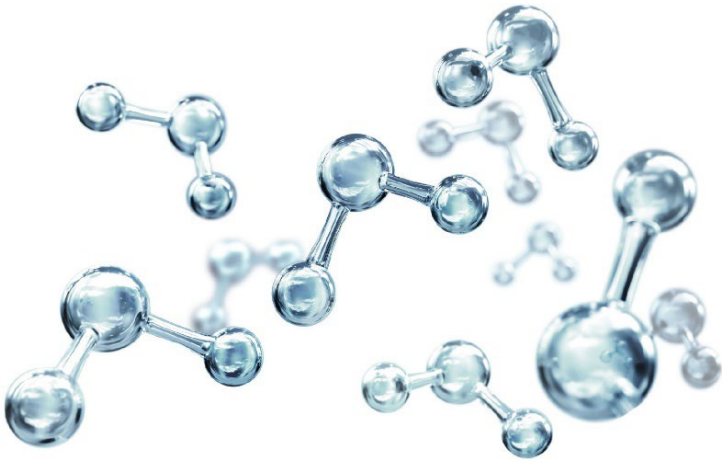
Seminar

CMWS Centre for Molecular Water Science

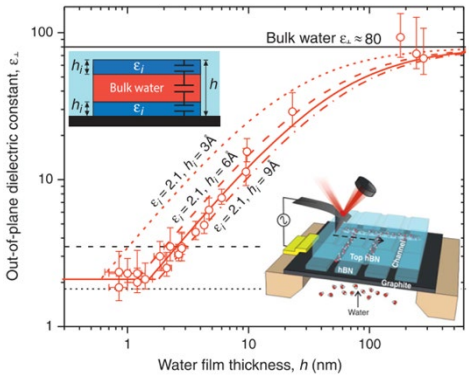


7th of November 2024
12:00 h

Zoom Virtual Meeting:
https://tuhh.zoom.us/j/82631283465
Meeting-ID: 826 3128 3465
Password: 978444

Dr. Laura Fumagalli
University of Manchester

Unraveling the dielectric properties of interfacial and nanoconfined water



The dielectric polarization properties of near-surface and nanoconfined water have long been a subject of investigation[1-3] due to their critical role in various phenomena, including intermolecular forces, ion and molecular solvation, transport, and chemical reactions[4-6]. While there have been extensive theoretical and computational studies in recent years[7-10], experimental evidence remains scarce due to technical challenges in measuring these properties in just few molecular layers of water near surfaces. After briefly presenting our experimental approach — based on highly sensitive scanning probe microscopy methods capable of probing local impedance[11-13] — I will present our recent findings on the dielectric constant of water near and confined between van der Waals crystals[14,15]. Our experiments revealed the presence of an interfacial water layer with dielectric properties significantly different from those of bulk water. In the direction perpendicular to the surfaces[14], we found that interfacial water exhibits an anomalously low dielectric constant under moderate confinement, down to strong confinement (~1 nm). Conversely, in the in-plane direction[15], the dielectric constant of interfacial water remains bulk-like under moderate confinement and increases to ferroelectric-like values under strong confinement. Furthermore, we observed that its in-plane conductivity also increases, reaching superionic values for quasi-2D water (1-2 nm). These findings offer new insights into various physical, chemical, and biological processes, and provides feedback for theoretical models that describe near-surface water and water-mediated interactions.

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