Contribution ID : **229** Type : **Oral**

Fluctuation x-ray scattering of self-assembled lipids, colloidal particles and liquids

Friday, 20 November 2020 11:10 (20)

Fluctuation x-ray scattering studies how the x-ray diffraction pattern changes as a small x-ray beam is scanned relative to the sample. The ensemble of diffraction patterns from different sample positions can reveal information about the local 3D structure in disordered materials. We have developed a fluctuation scattering technique called the pair-angle distribution function (PADF) method that recovers three- and four-body correlations in the sample, including local angular structure[1,2]. This is a natural generalisation of the pair-distribution function obtained from small-angle x-ray scattering (SAXS). Here we present recent applications of the PADF technique to self-assembled lipids[3] to reveal distortions of the water channel shape with lipid composition. We discuss the potential application to disordered, dense packings of colloidal particles to distinguish dominant icosahedral, face-centred cubic, body-centred cubic or hexagaonal packings[4]. Looking further into future, we discuss the potential applications to liquid structure with x-ray free-electron lasers.

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Primary author(s) : MARTIN, Andrew (RMIT University)

Co-author(s) : Dr BINNS, Jack (RMIT University); Dr ADAMS, Patrick (RMIT University); GREAVES, Tamar (RMIT University); DARMANIN, Connie (La Trobe)

Presenter(s) : MARTIN, Andrew (RMIT University)

Session Classification : Session 10 - Chemistry, Catalysis and Soft Matter

Track Classification : Chemistry, Catalysis and Soft Matter