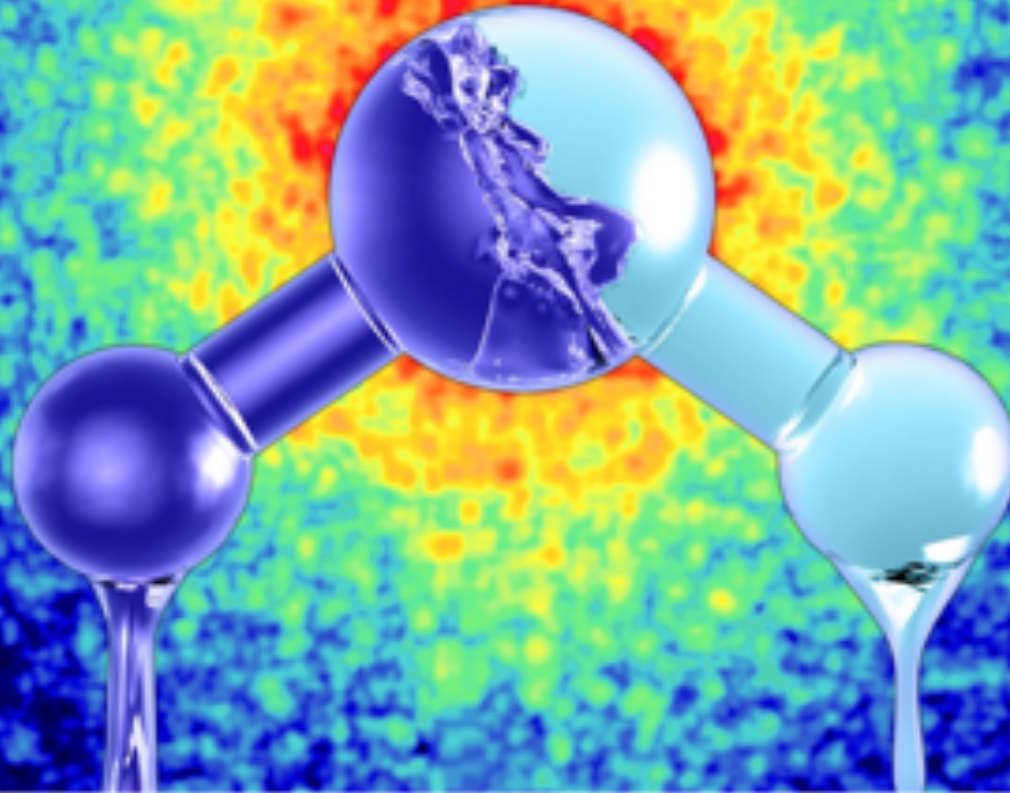




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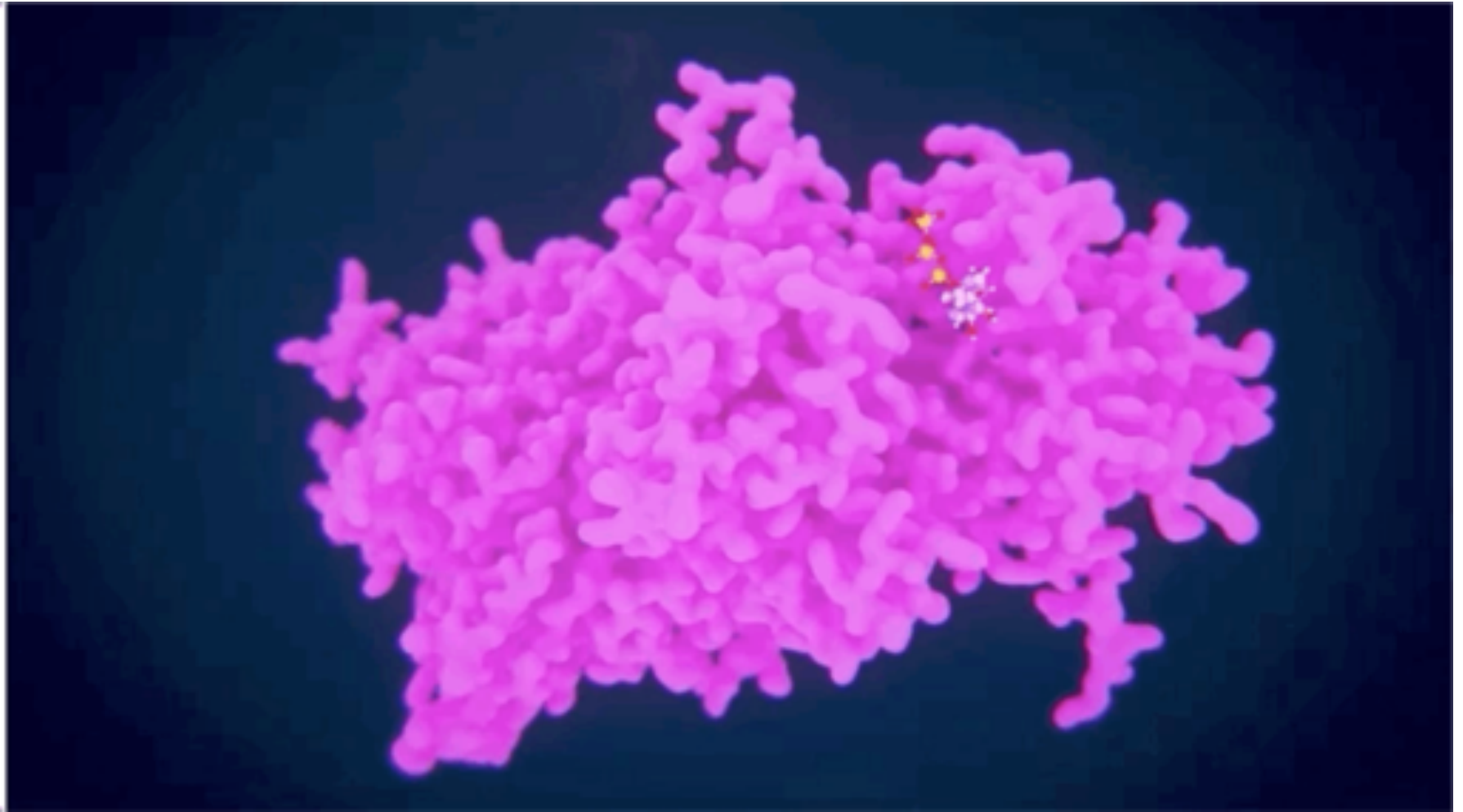
## **Dynamics in Complex Systems:**

From supercooled and glassy water to protein dynamics

UK X-FEL Science case: workshop on Chemical dynamics and energy

Newcastle University , 11 Dec. 2019

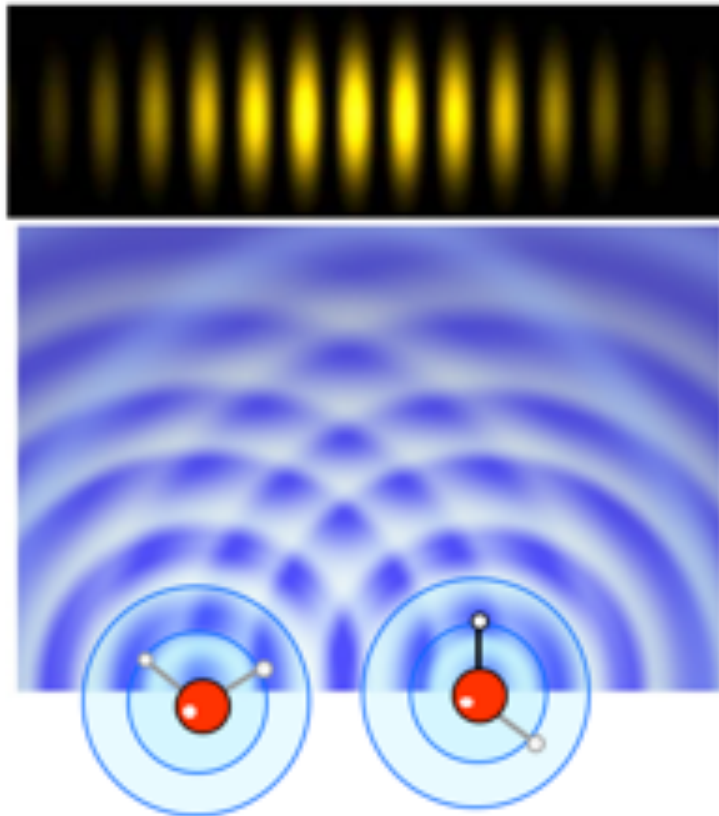
# Let's make protein movies!



All-atom Molecular Dynamics Simulation of the Bacterial Cytoplasm - Rikenchannel

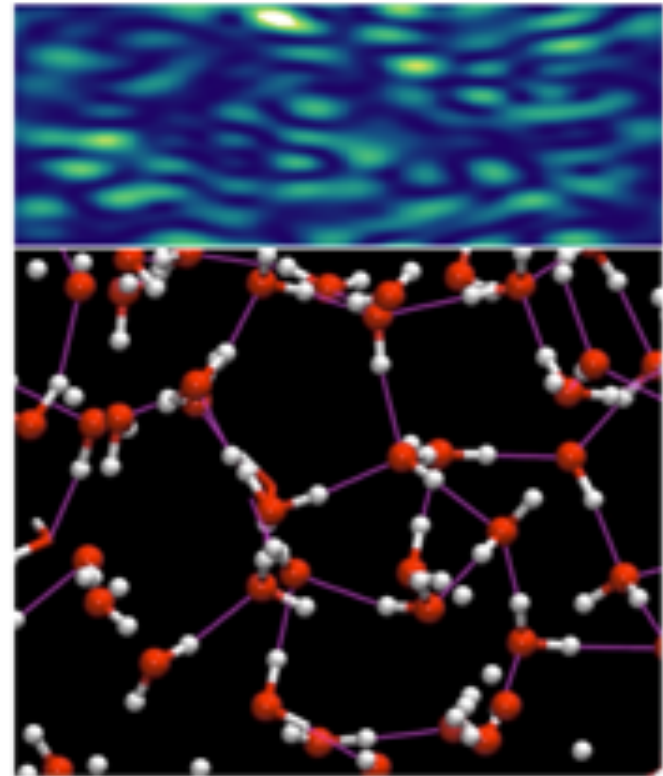
# The speckle pattern

Interferogram



2 scattering points

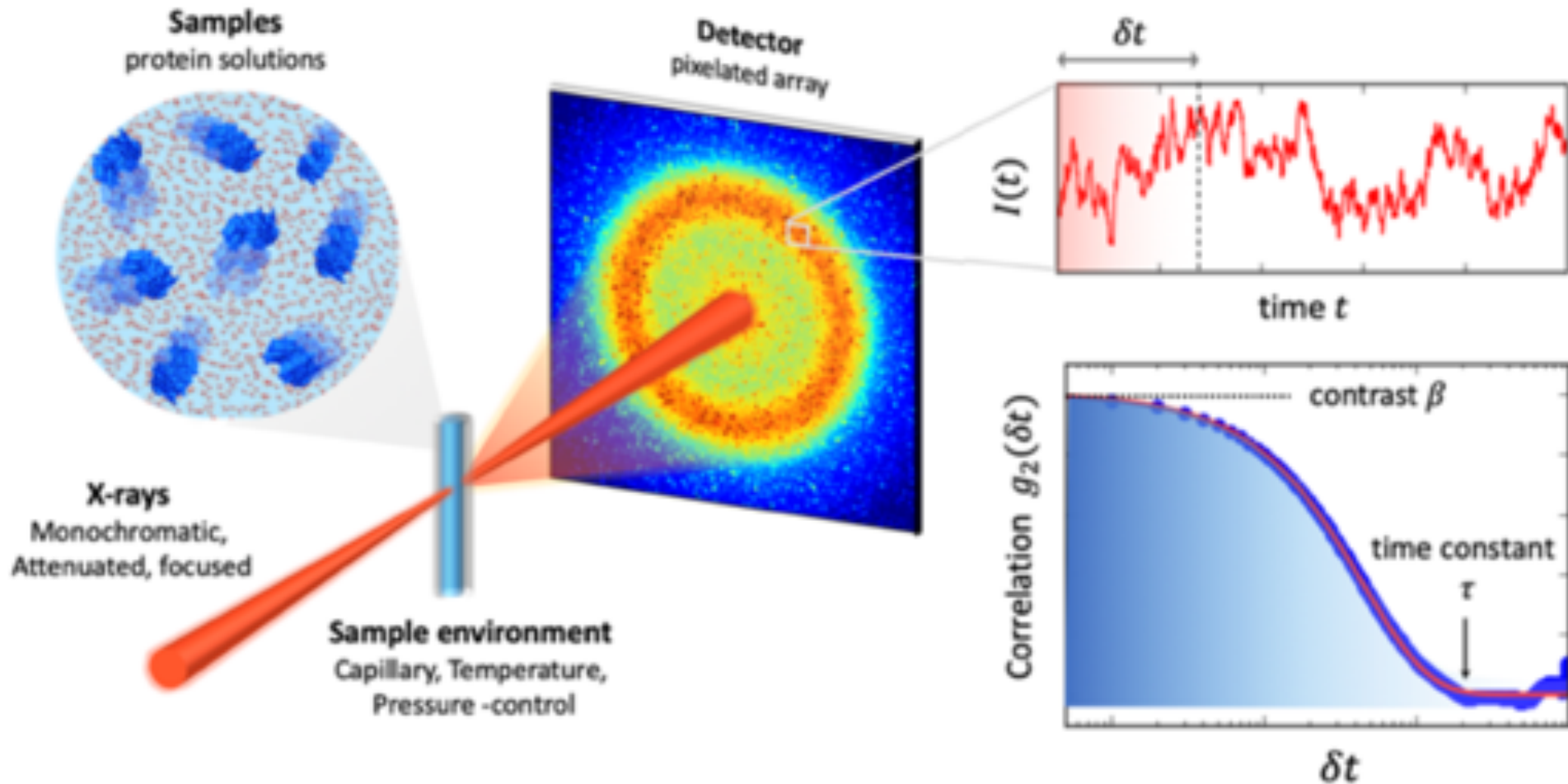
Speckle pattern



Many scattering points

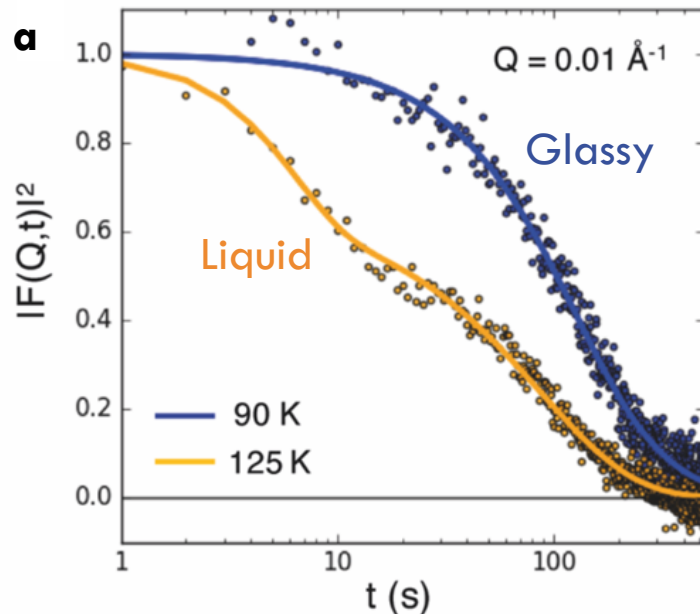


# X-ray Photon Correlation Spectroscopy



# XPCS of supercooled water

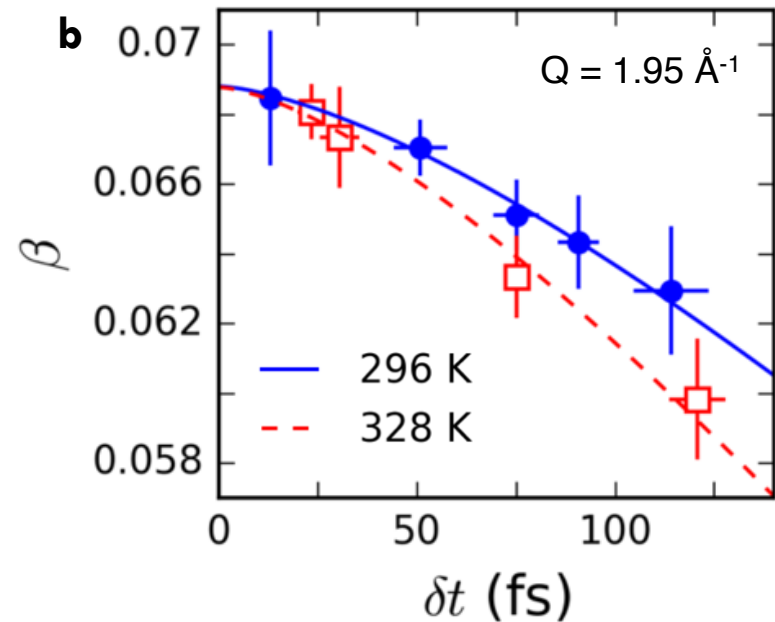
## X-ray Synchrotrons



Water dynamics near  
the glass-transition

F. Perakis *et al.*  
*PNAS* 114, 819 (2017)

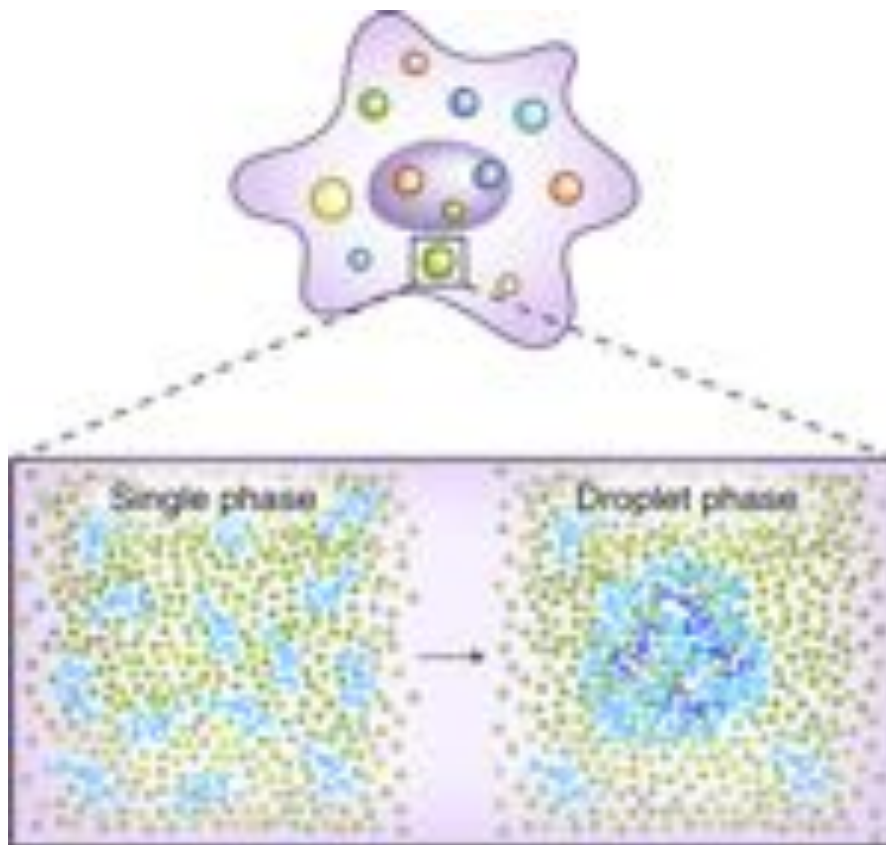
## X-ray Free-electron lasers



Ultrafast dynamics of liquid  
and supercooled water

F. Perakis *et al.*  
*Nat. Commun.* 9, 1917 (2018)

# Protein dynamics in high concentrations



## Protein liquid-liquid phase separation (LLPS)

- membrane-less compartments
- important for concentrating biomolecules
- What is the role of LLPS in the cell?



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# Thank you for your attention!