3 minutes pitch contest

Tao Sun
Michael Mlodzianoski
Claudia Stocks
Michael Jones
Kyle Clunies-Ross
Zahra Raza
Mahya Mohammadi
Martin Sadraeian
Isa Ahmadalidokht
Nehad Elsalamouny
Shikun Ma
Holden Paz
Nisha Mehta

Silanna UV

3i Intelligent Imaging Innovations

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UOW Australia

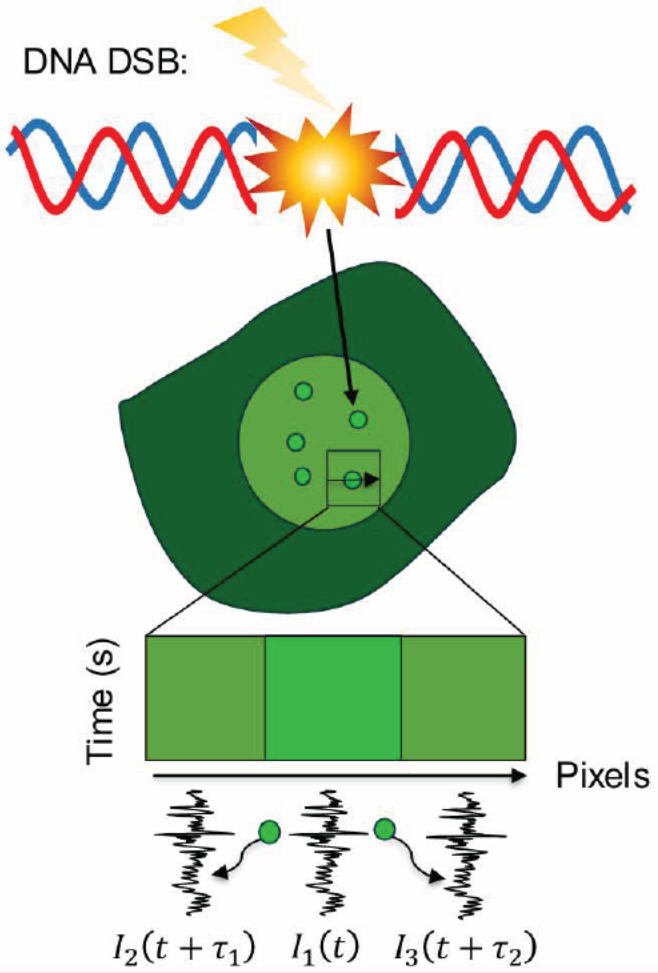
Speaker's Name

Next Speakers

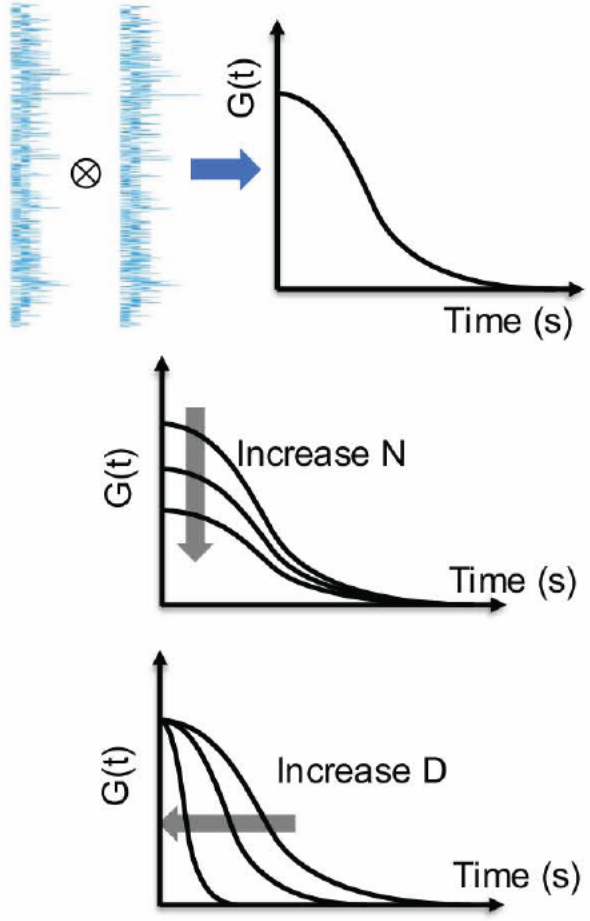
Higher order correlation spectroscopy: a tool for the study of nuclear condensate

Poster #2

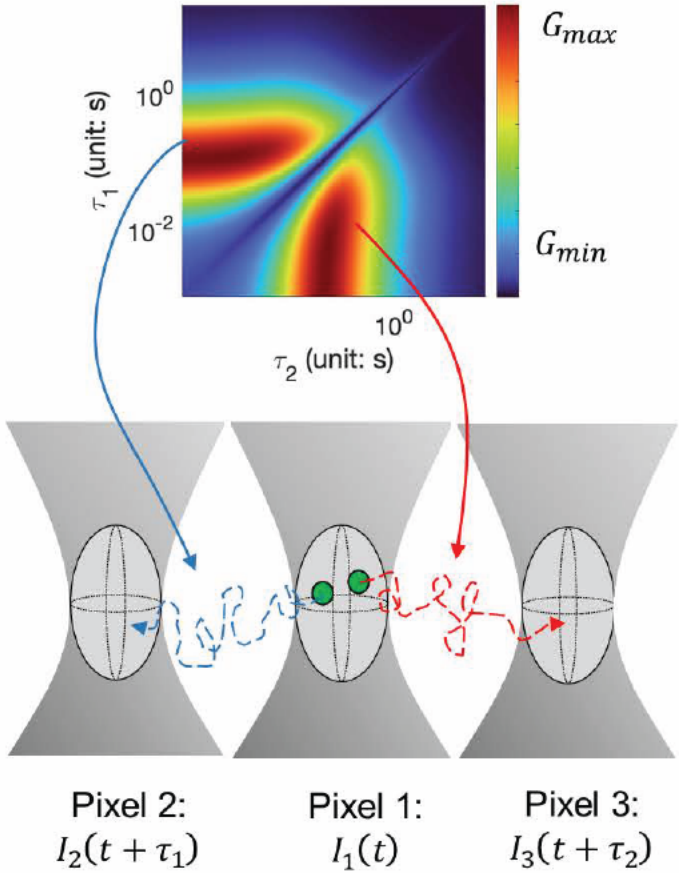
Line scan acquisition



Second order auto correlation spectroscopy

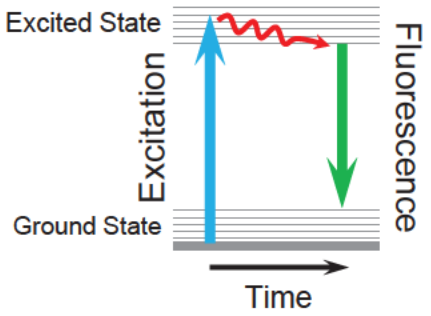


Third order pair correlation spectroscopy



Quantum Fluorescence Lifetime Imaging Microscopy

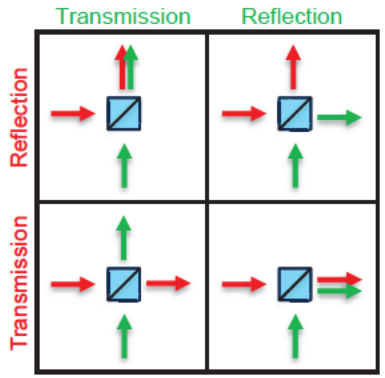
Fluorescence Lifetime



Temporal Resolution ~0.1 ns
Limited by:
Electronic Readout
Excitation Pulse Duration

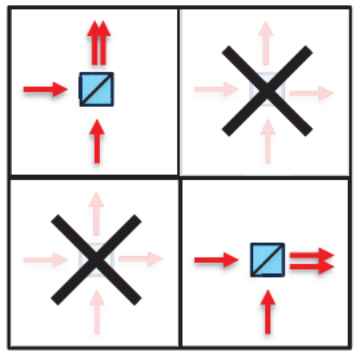
Classical Light Behaviour

50% reflection, 50% transmission



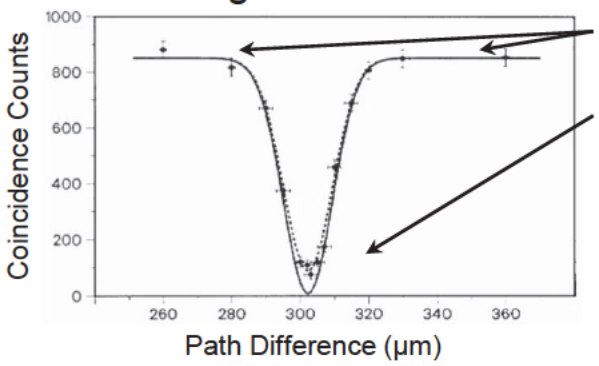
Quantum Light Behaviour

Hong-Ou-Mandel Interference



- Indistinguishable photons
- Photons Interfere and Entangle
- Entangled Photons leave together

Measuring HOM Interference



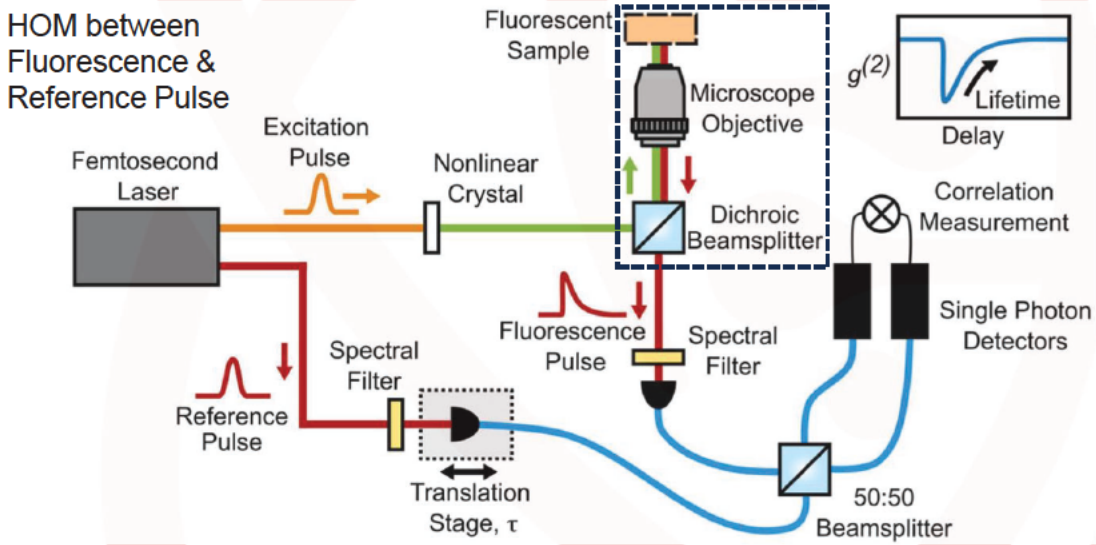
Coincidences

Entangled Photons break coincidence

Width corresponds to a resolution of ~100 fs.

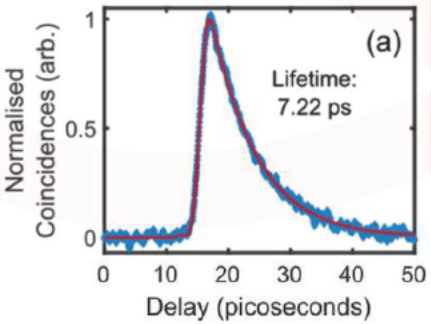
Hong, Ou, Mandel 1987

Microscope Layout



Lyons et al 2023

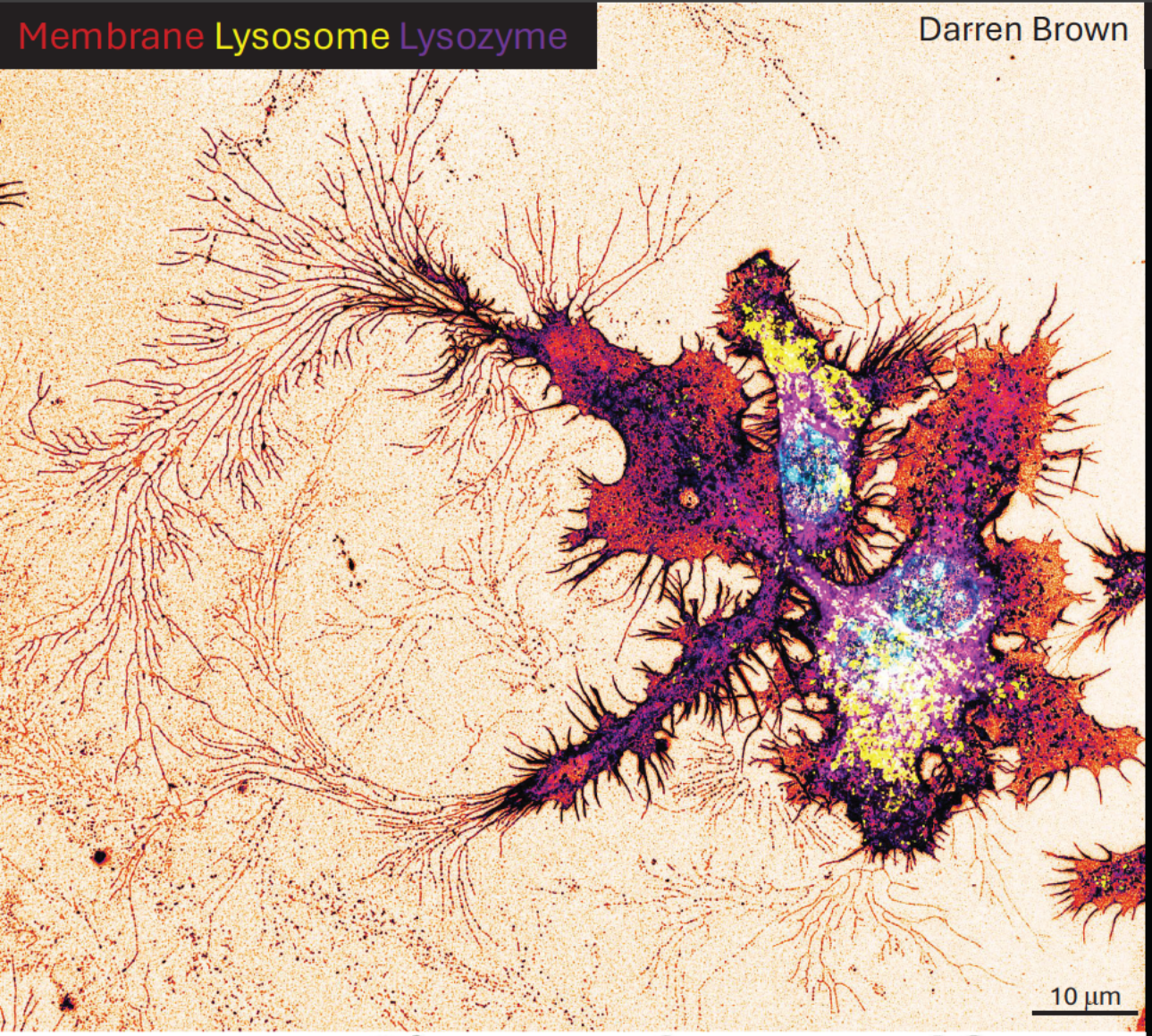
Results: 4-DASPI in Water

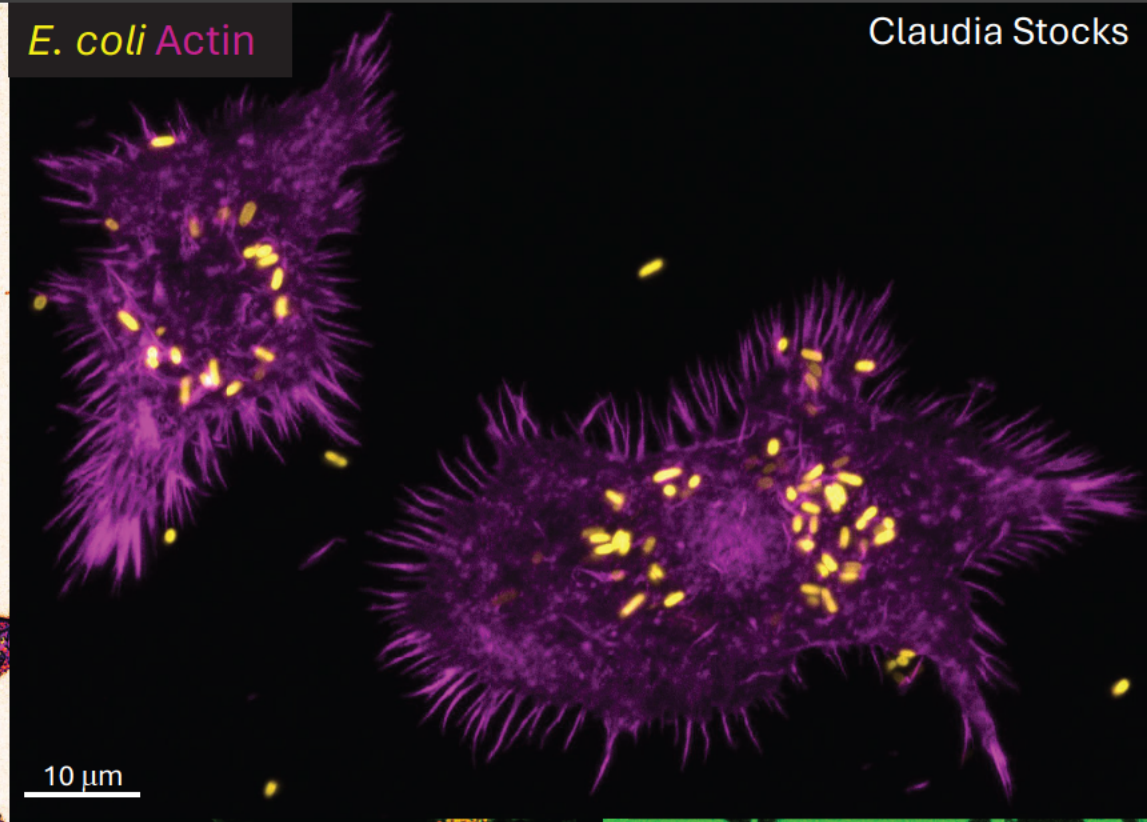


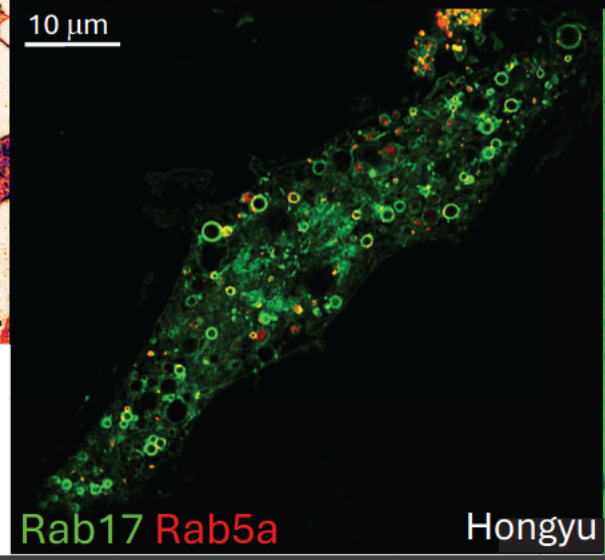
Lyons et al 2023

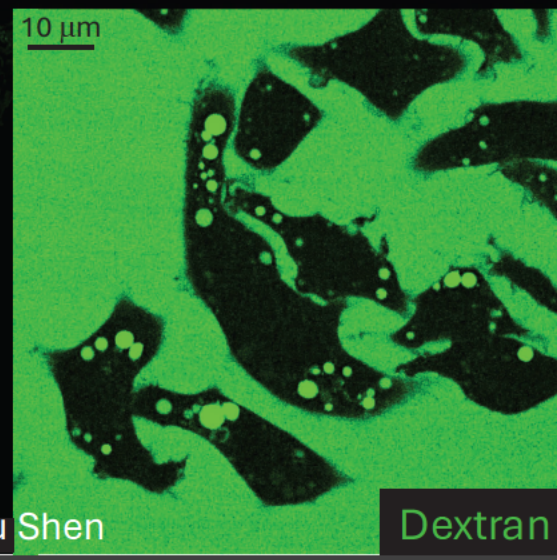
40 minutes total time
7.22±0.04 ps lifetime

Critical Next Steps:
Improve throughput
Convert to a confocal set up to record images







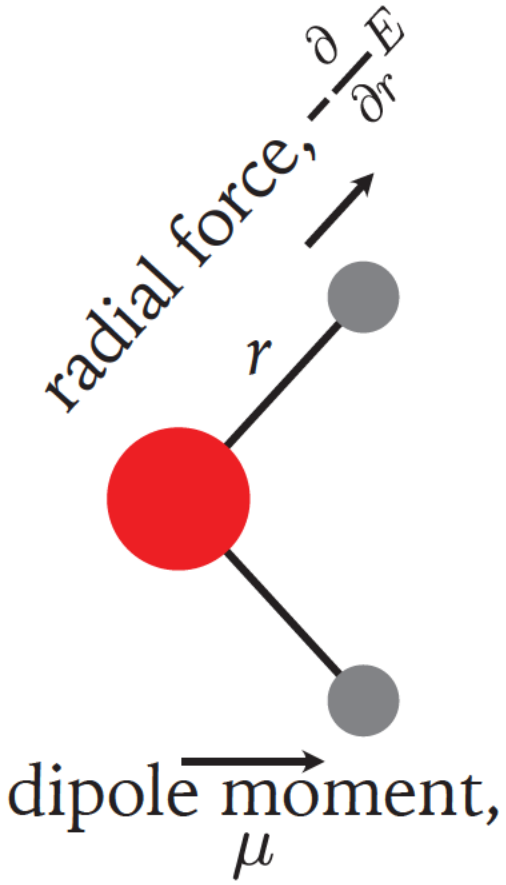


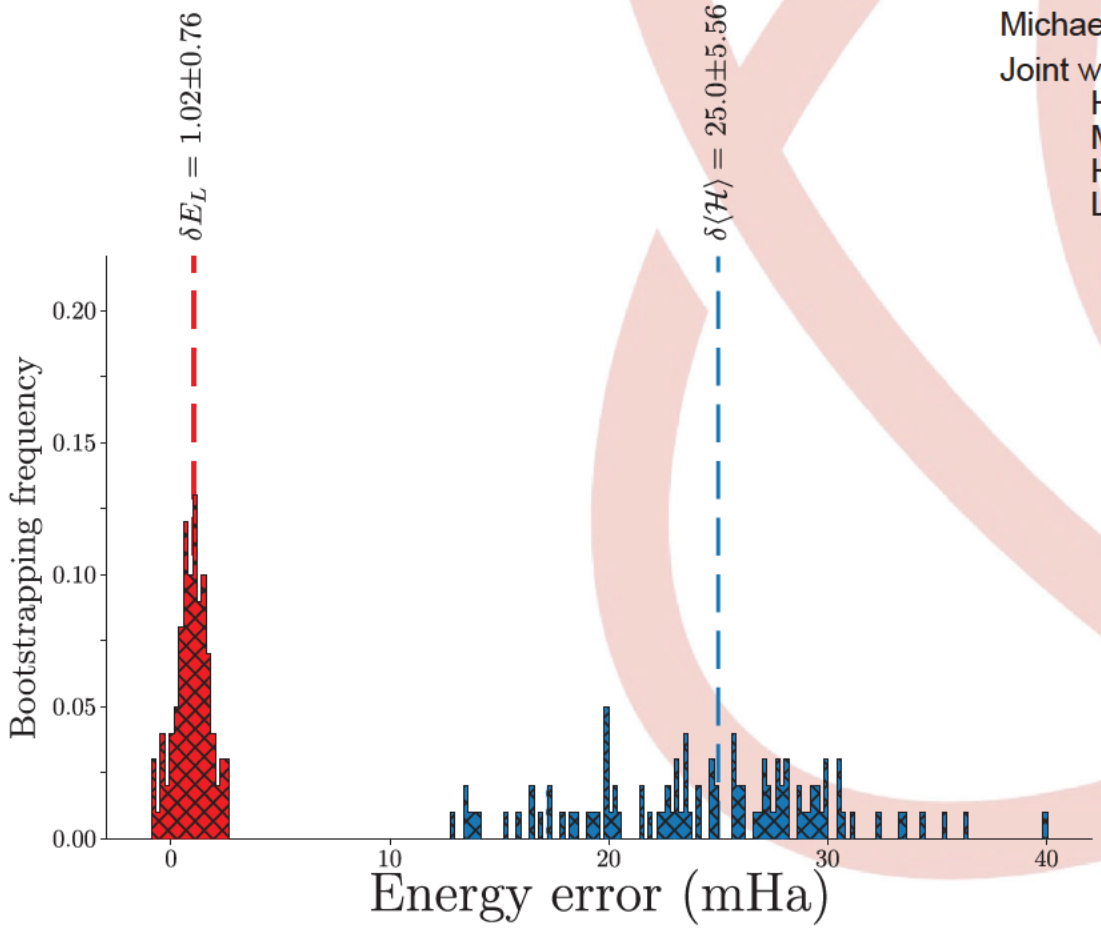
Claudia Stocks

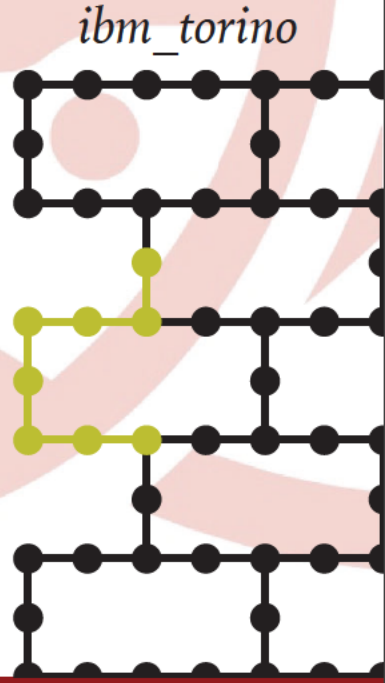
Next: Michael Jones --> Kyle Clunies-Ross

Ground-state-energy calculation for the water molecule on a superconducting quantum processor

Michael A. Jones (UoM, QUBIC),
Joint work with:
Harish J. Vallury (UoM),
Manolo C. Per (CSIRO, QUBIC),
Harry M. Quiney (UoM),
Lloyd C. L. Hollenberg (UoM, QUBIC)







IBM Quantum Network Hub at the University of Melbourne
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Improved imaging resolutions with quantum information

Problem:

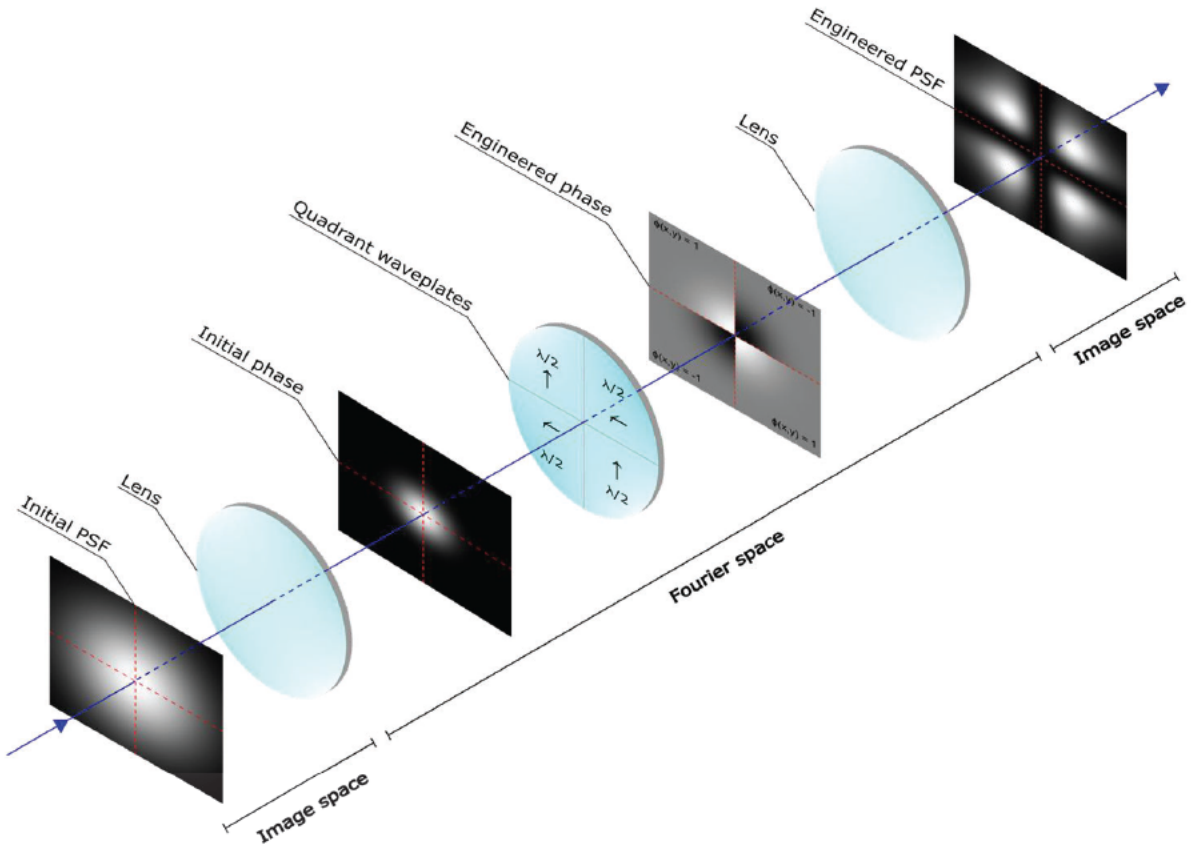
- Fundamental diffraction limit for visible light: ~200 nm in direct microscopy
- Smaller wavelengths damage samples

Solution:

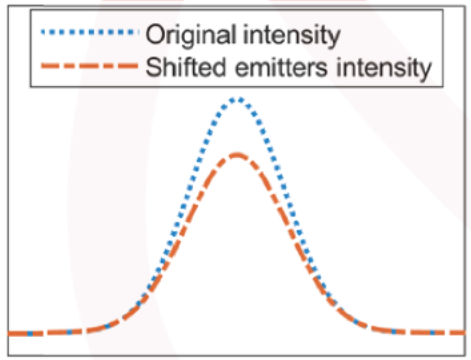
- Leverage Bayesian inference and PSF engineering to improve resolutions
- Bias correction improves accuracy

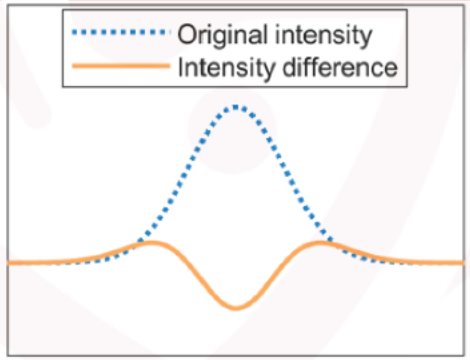
Validation:

- Experiments can resolve separations down to 50 nm with a simple setup
- Waveplates improve precision by 2x

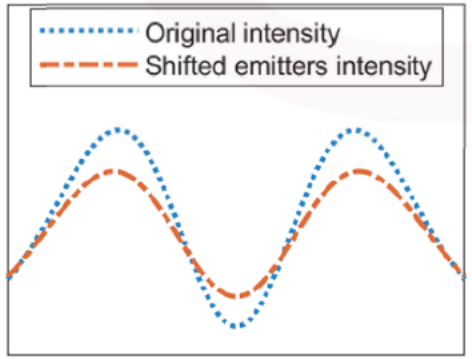


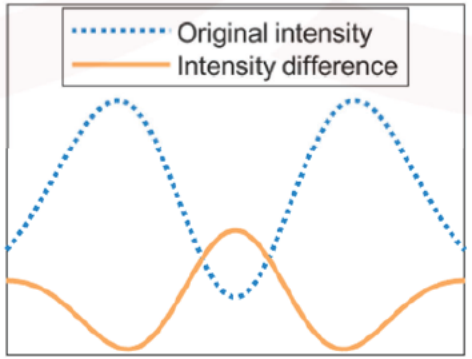
without waveplates:



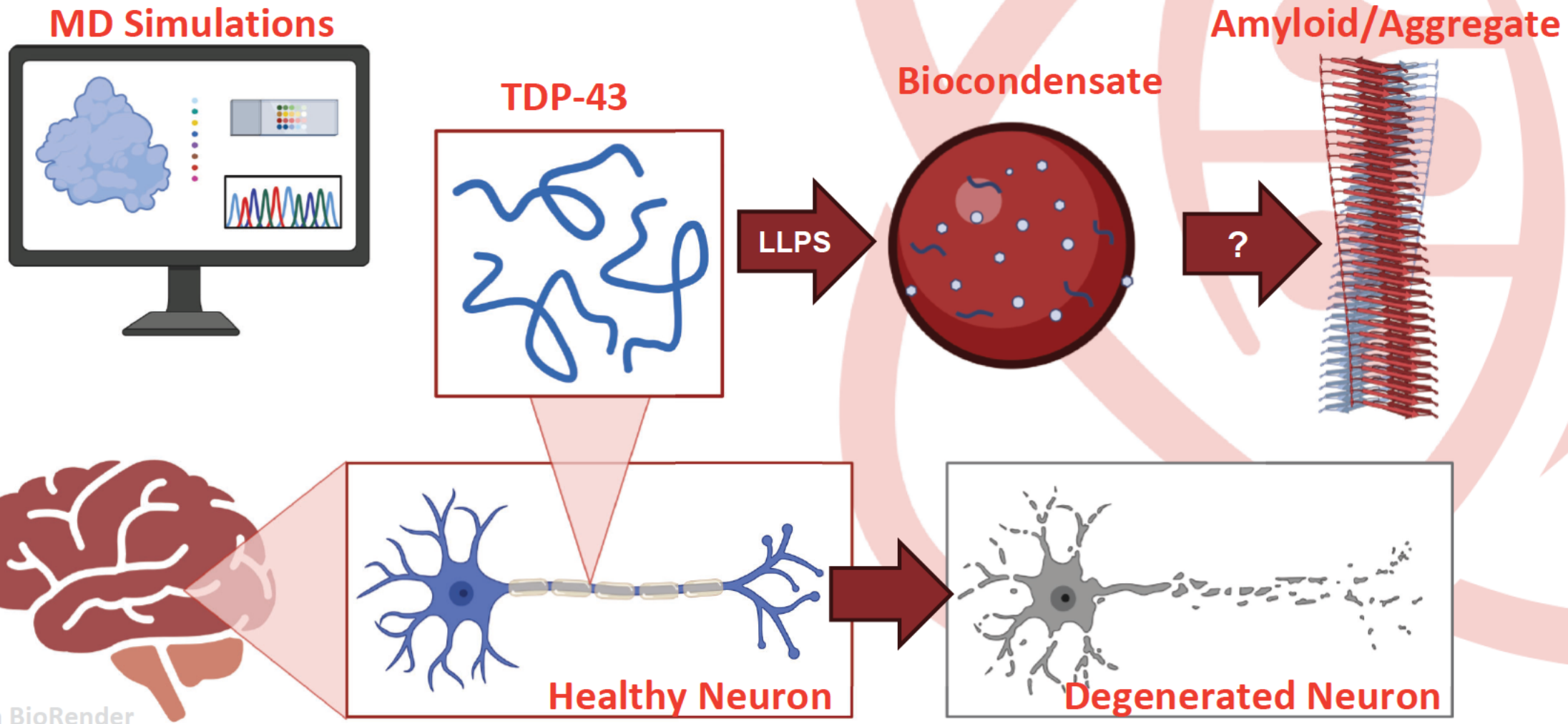


with waveplates:





Understanding TDP-43 Aggregation using MD Simulations



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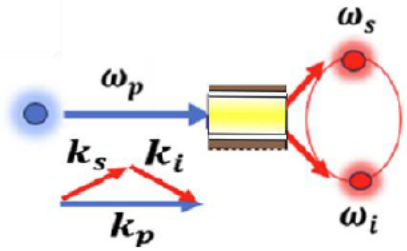
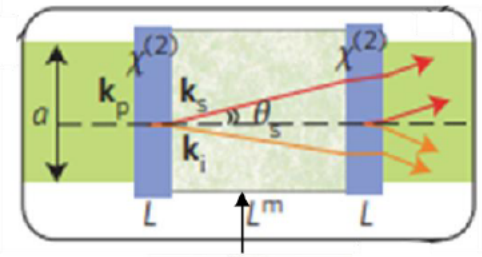
AUSTRALIA
THE UNIVERSITY OF MELBOURNE
UOW AUSTRALIA

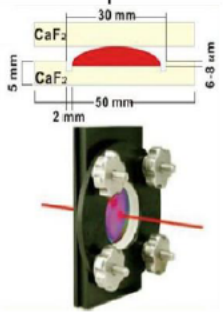
Quantum Spectroscopy; Spectroscopy with undetected photons in the mid-infrared

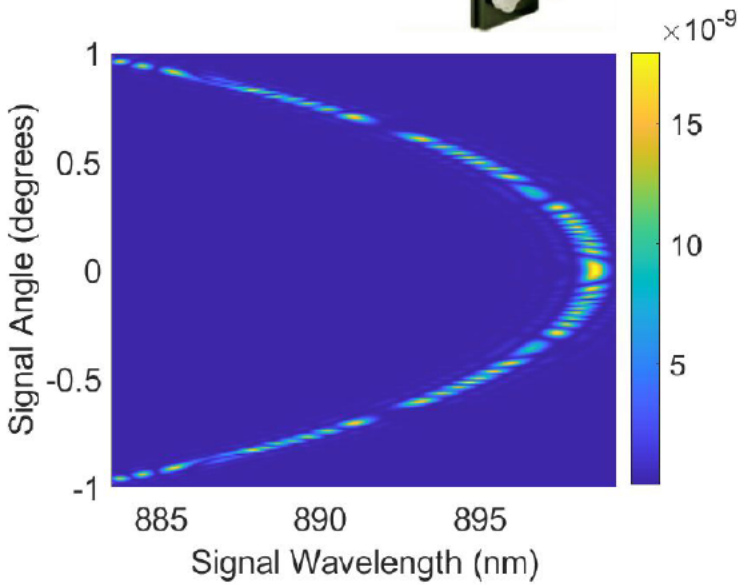
Optical Setup Design

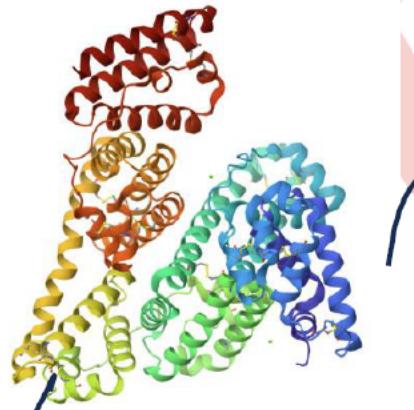
Isa Ahmadalidokht, **Mahya Mohammadi**, Christopher Poulton, Irina Kabakova, Alexander Solntsev

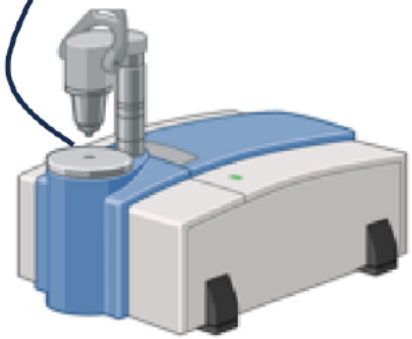


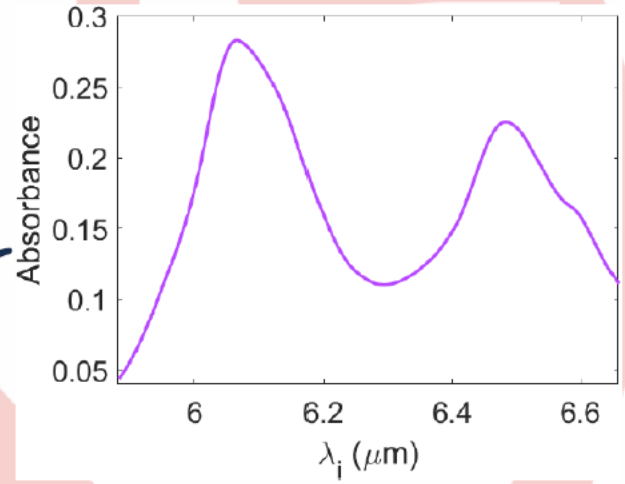


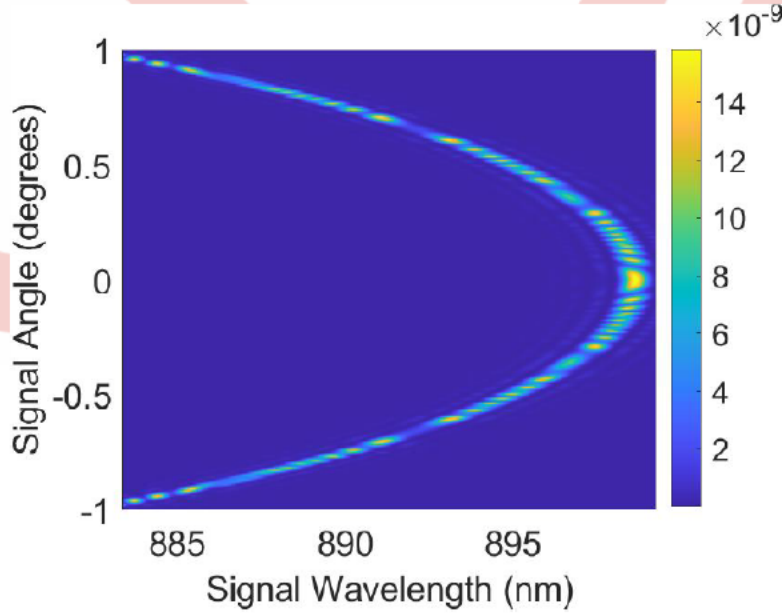








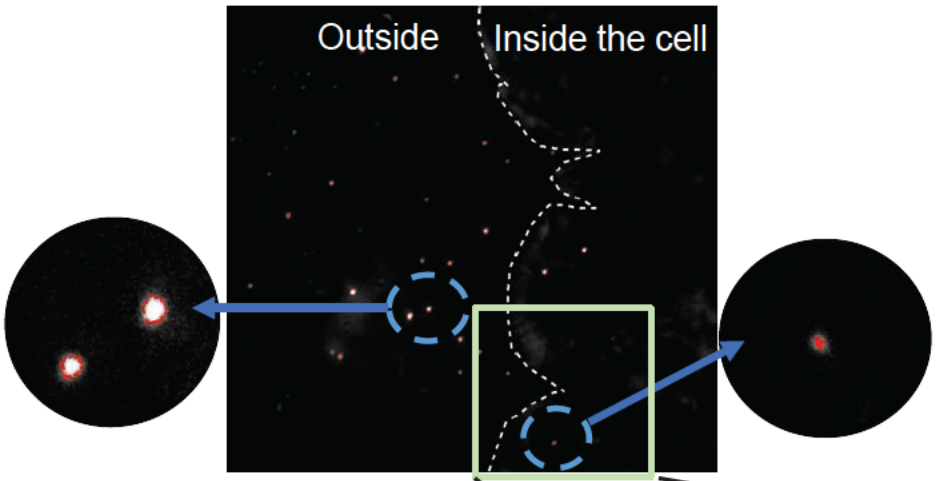


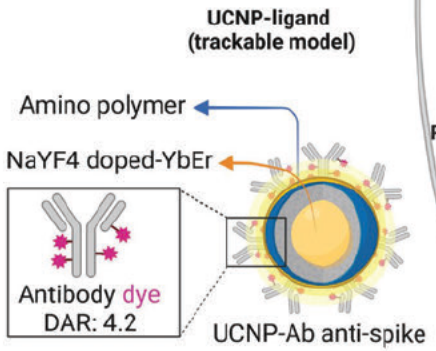


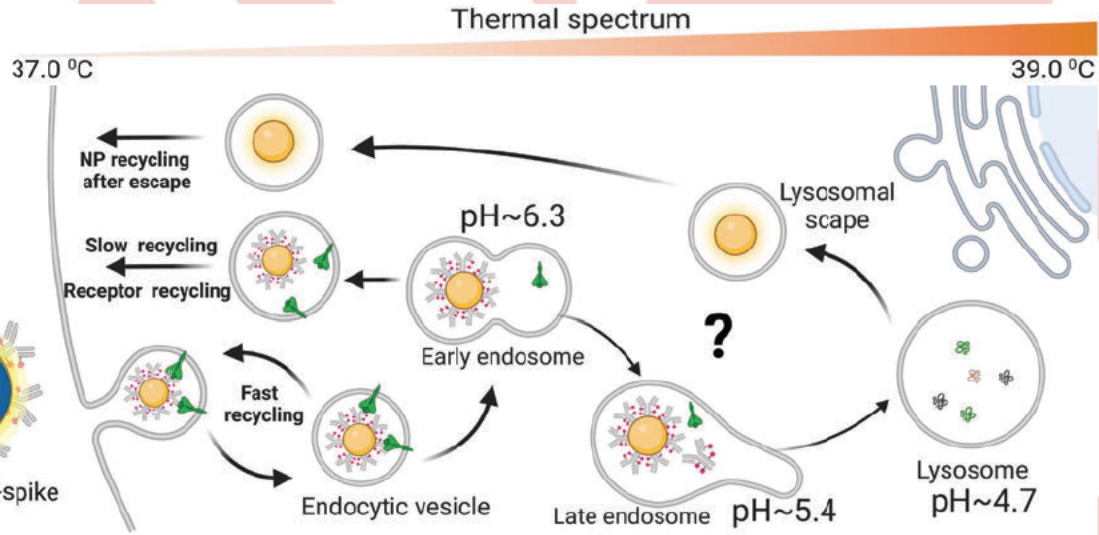
Tracking of virus spike in a single cell using upconverting microscopy

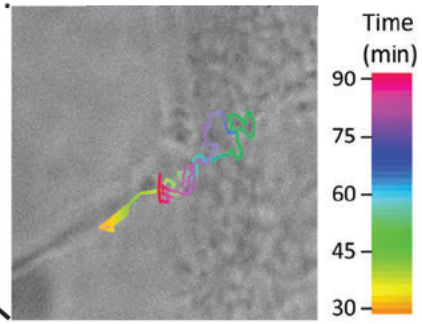
Advantages of Upconversion in imaging and sensing

- Exceptional brightness and photostability.
- Tracking of cell organelles and their dynamics
- Sensing capability - Temperature dynamics of virus antigen in infected cell









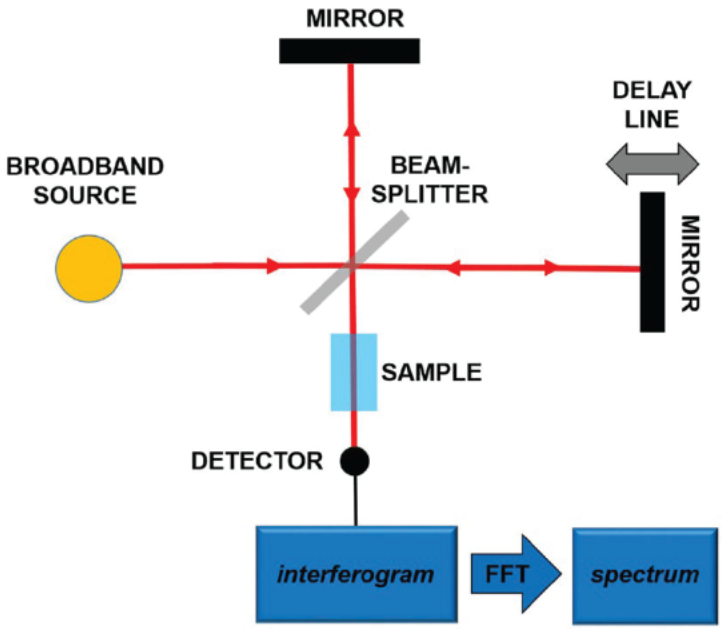
Trajectories of a single UCNP-spike showing a rapid recycling from 30 min to 75 min.

Quantum Microscopy; Microscopy with undetected photons in the mid-infrared

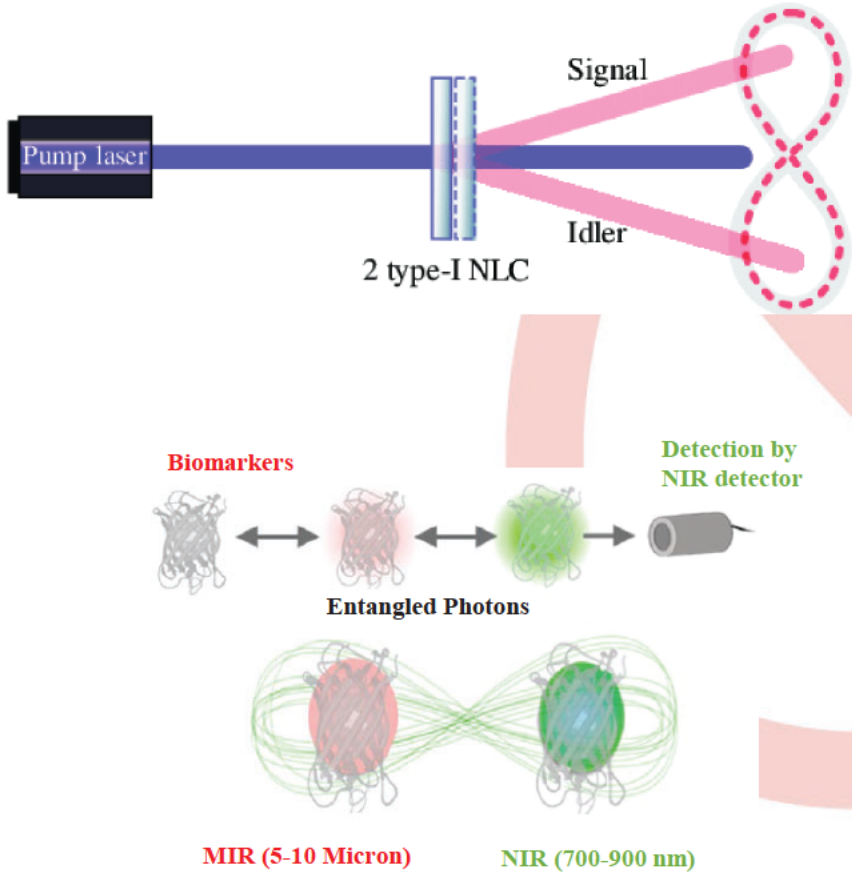
Optical Setup Design

Isa Ahmadalidokht, Mahya Mohammadi, Christopher Poulton, Irina Kabakova, Alexander Solntsev

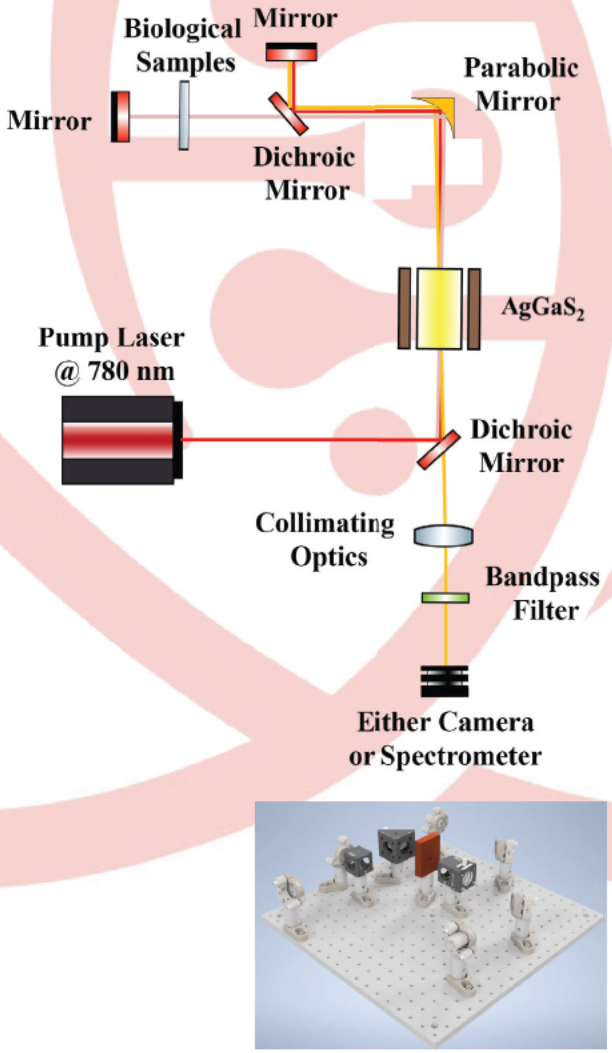
FTIR Spectroscopy



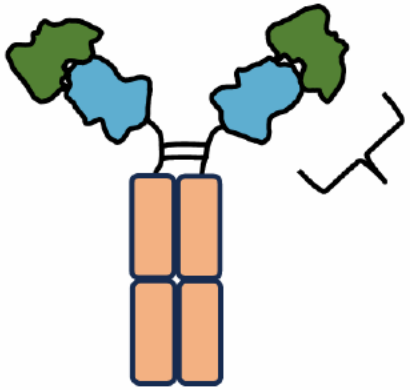
SPDC



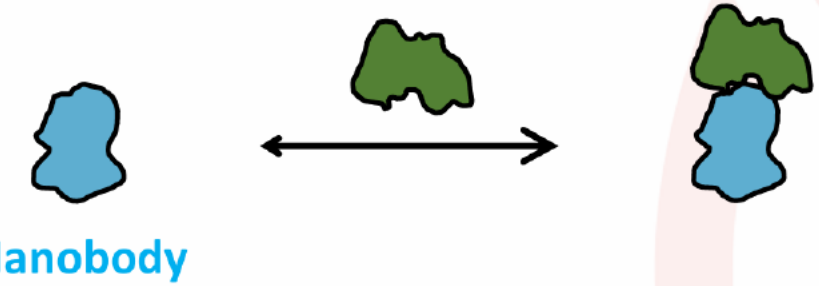
Quantum Microscopy

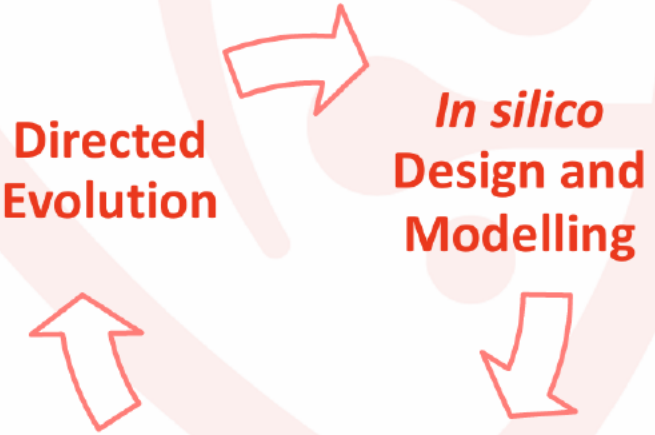


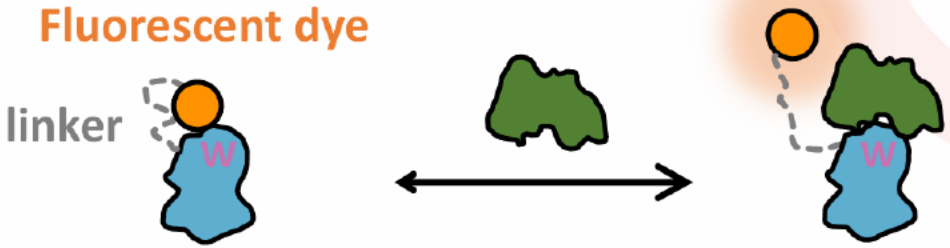
Rationally Designed Quenchbodies: Advancing Fluorescent-based Diagnostics



Heavy-chain-only antibody







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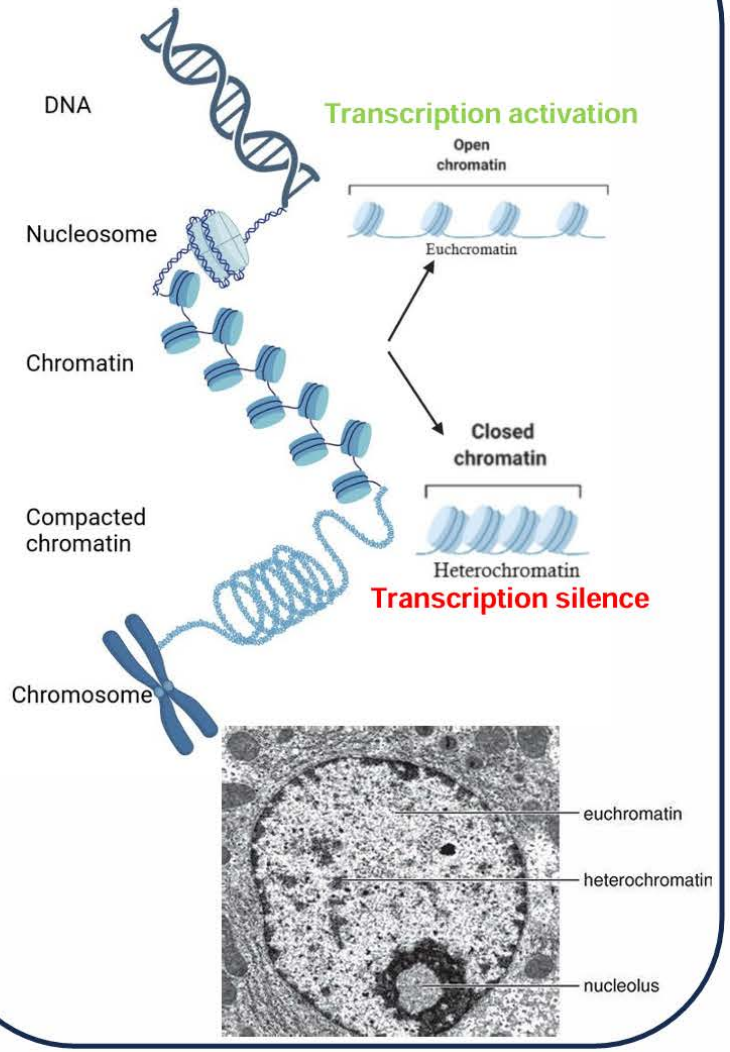
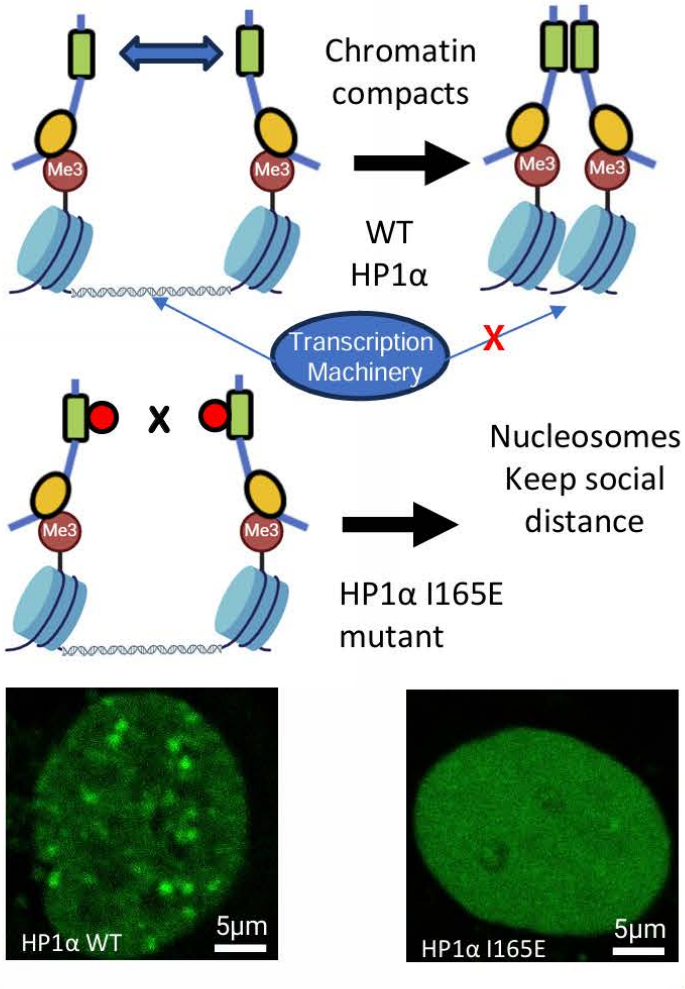
ChromaCRY: an optogenetic tool to shut down a genome

Introduction

Cell nucleus architecture

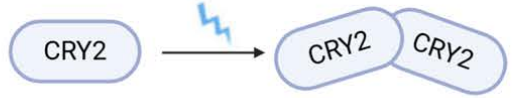


Heterochromatin protein 1 alpha (HP1α)

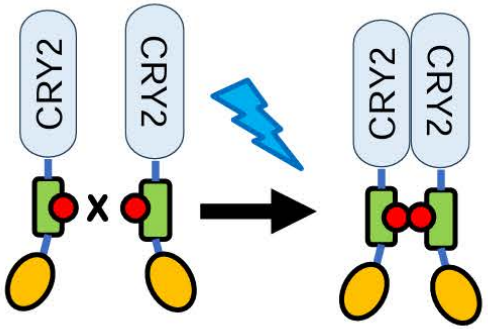


Methods

Cryptochrome 2 (CRY2)

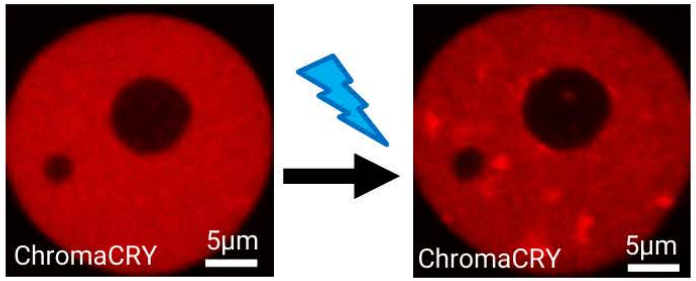


Homodimerization upon **blue light** stimulation



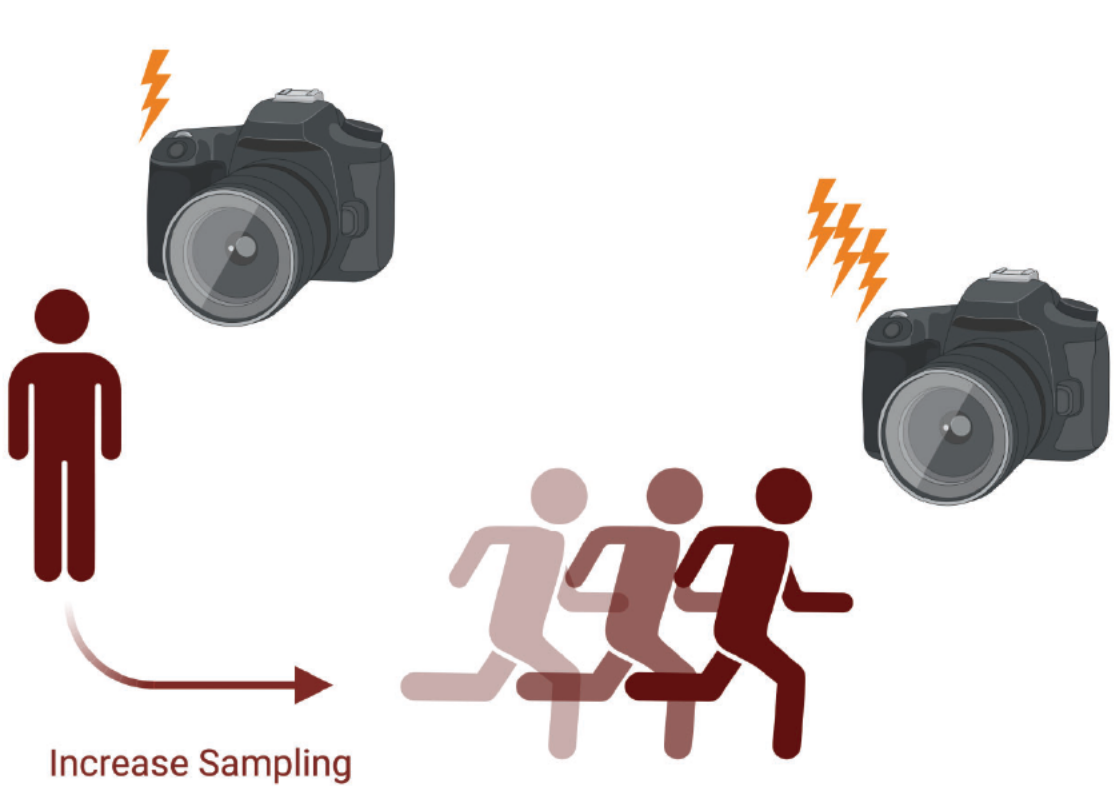
Chromatin compaction via **Cry**ptochrome 2

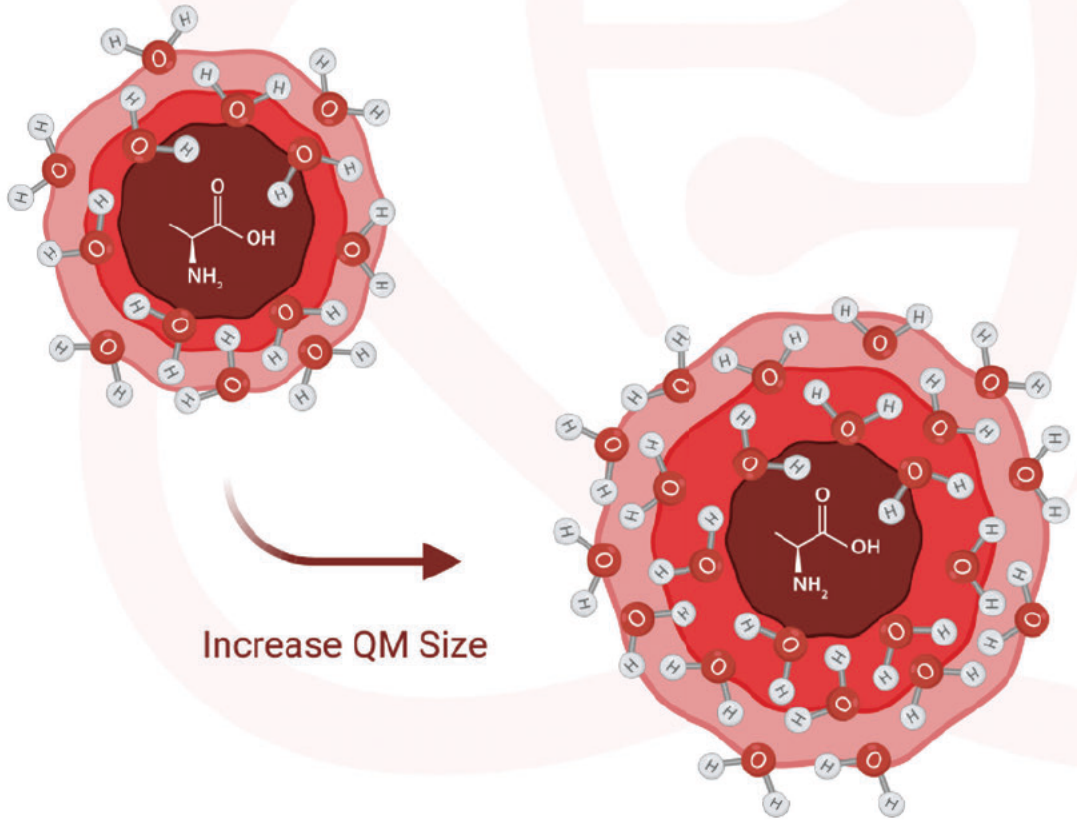
ChromaCRY



Poster # 11

The Effects of Conformational Sampling and QM Region Size in Adaptive QM/MM Simulations





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Key Challenge:
Slow Basis Set Convergence

Explicitly Correlated Double Hybrid DFT



Thank you!