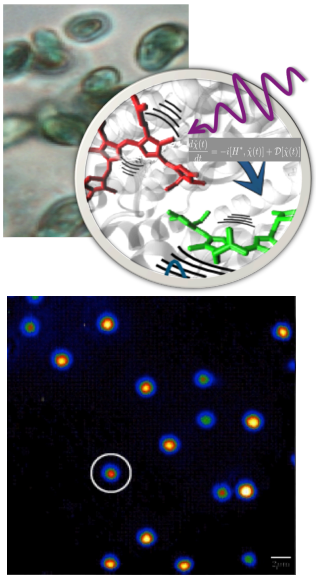
Quantum biology on a chip:
investigating the optical properties of single biomolecules within nanofabricated photonic devices

The progress in fundamental science and technology has allowed researchers to explore intriguing, but often elusive, quantum effects in atoms, ions and semiconductor nanostructures. Cryogenic temperatures and complex trapping techniques are often required to be able to access these fragile quantum states. Surprisingly, despite the requirement of relatively high temperatures and condensed-phase operation, there is a growing body of evidence that some biological molecules could host superpositions of quantum states for the time-scale of picoseconds.
To move our understanding of quantum effects in biomolecules forward, we need experimental proofs that will give unambiguous evidence of quantum dynamics. The importance and potential benefits of this research span fundamental physics and biology, with possible technological applications in enhanced energy harvesting and quantum information technologies.



**The top panel shows a representation of the pigments (red and green) bound to proteins (grey) in the photosynthetic apparatus of cryptophyte algae.
The lower panel shows a photoluminescence image of the quantum light emitted by single-photon sources**

This project therefore aims at integrating cutting-edge quantum technology to the investigation of quantum effects in biomolecules. We will use platform technologies such as microfabricated single-photon emitters, photonic waveguides and optical cavities. Leveraging the combined technologies will enable us to probe quantum states in single complex biological systems, going beyond current spectroscopic techniques.

The student will gain expertise in optical spectroscopy, quantum optics, nanofabrication and biochemistry. She/He will have access to the state-of-the-art £120M nanofabrication facilities at the University of Southampton and will carry out an interdisciplinary research project at the interface between quantum physics and biology.

This interdisciplinary project is run in collaboration with James Sturgis, Professor of Biochemistry at Aix-Marseille Université (France), and Alexandra Olaya-Castro, Professor of Physics at University College London (UK).
The student will spend at least 6 months in Marseille working on the synthesis of the biomolecules that will be optically characterized in Southampton. Theoretical support will be provided through the interaction with the group in London.
The student will also attend regular meetings, carried out in Paris, to interact with other students working in the same field.

The position is fully funded for European students and the project is expected to start latest in February 2020.

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