Welcome Seminar

30 Maggio 2025 - h15:00
Aula A

Dr. Alessandro Agostini
Ricercatore a tempo determinato in *tenure track*

Dipartimento di Scienze Chimiche
Università degli studi di Padova

Photoprotective mechanisms in photosynthetic proteins: a bountiful research topic for a spectroscopist.

Photosynthetic organisms harvest sunlight across a vast range of environments by striking a delicate balance between efficient light capture and effective photoprotection. In this seminar, through examples from my past and present research activity, I will explore the molecular strategies that underlie this balance in pigment–protein assemblies, showing how subtle adjustments in pigment composition and protein scaffolds direct the flow of excitation energy.

By leveraging Electron Paramagnetic Resonance (EPR) and Optically Detected Magnetic Resonance (ODMR), it is possible to exploit photoexcited triplet states of chlorophylls and carotenoids as built-in sensors of their electronic surroundings and energy-transfer networks. ODMR, in particular, affords unparalleled spectral resolution in complex multi-chromophoric systems by separating overlapping triplet signals. When combined with theoretical modeling, these measurements illuminate how fine-tuned excitonic interactions accelerate triplet–triplet energy transfer (TTET), dissipating excess energy before it can form damaging reactive oxygen species.

Understanding the general design principles employed by plants, algae, and bacteria to optimize their interaction with light—subtle tuning of electronic interactions, strategic pigment substitutions, and tailored protein environments—is at the core of my current research efforts in the EPR group. Importantly, the high sensitivity and resolution of ODMR also hold great promise for studying a wide range of other chromophores, paving the way for future applications in photocatalysis and organic photovoltaics.

Il Direttore del Dipartimento - Prof. Stefano Mammi