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INSTITUTE FOR THEORETICAL ATOMIC, MOLECULAR AND OPTICAL PHYSICS
at the Harvard-Smithsonian Center for Astrophysics and Harvard Physics Department, Cambridge MA USA

HARVARD Quantum Optics Center

Joint Quantum Sciences Seminar

Wednesday | Nov. 14 | 4:00 pm
Jefferson 250

Alán Aspuru-Guzik

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"Molecules as Quantum Processors: Ultrafast quantum process tomography to study excitonic coherence in molecular systems."

Ultrafast experiments carried out on several photosynthetic complexes from many groups around the world have shown long-lived (~100 fs - 1 ps) quantum oscillations in two-dimensional optical spectra. Evidence suggests that these are electronic in nature, but they could be vibrational in character. Our group introduced and adapted a powerful tool from quantum optics and quantum information, quantum process tomography, for its use in condensed-phase molecular experiments. We also have recently proposed an ultrafast pump-probe scheme to distinguish between vibrational and electronic coherences as a *witness* for electronic coherence. In this colloquium-level talk, I will describe QPT and its application to ultrafast molecular experiments. I will describe the first experimental application of the technique, which is an ongoing collaboration with Keith Nelson (MIT) on a double-walled self-assembled molecular aggregate. Our QPT results show evidence of coherent exciton transport between two J-aggregates at room temperature. Finally, I will conclude with our simulations of a natural molecular self-assembled aggregate: the Chlorosome antenna complex of green-sulfur bacteria. These simulations provide insight into the inner workings of the light harvesting apparatus of this remarkable organism that can survive in very low-light conditions.

Student Presentation by Arghavan Safavi-Maini
"Quantum Phases of Dipolar Bosons in Bilayer Geometry"

Student Presentation will begin promptly at 4:00 PM
Guest Presentation will begin promptly at 4:30 PM