SEMINAR ANNOUNCEMENT

國立中山大學物理系113學年度第二學期專題演講

Chemistry Meets Plasmon Polaritons and Cavity Photons: A Perspective from Macroscopic Quantum Electrodynamics

許良彥 副研究員

Dr. Liang-Yan Hsu

Associate Research Fellow, Institute of Atomic and Molecular Sciences, Academia Sinica

Abstract:

Light-molecule interactions under quantum electrodynamics (QED) have long been less emphasized in physical chemistry as semi-classical theories have been the prevailing framework due to their conceptual simplicity and practical applicability. Recent experimental advances in polariton chemistry highlight the need for a theoretical framework of QED. In this talk, I will present macroscopic QED as a unified framework that integrates infinite photonic modes and dielectric environments into chemical systems, offering a comprehensive approach to exploring QED phenomena in chemistry. First, we have developed a generalized molecular fluorescence theory, extending the Chance-Prock-Silbey model, capable of providing parameter-free predictions for fluorescence across weak to strong light–matter coupling regimes. Second, our generalized theory of resonance energy transfer incorporates both retardation effects and complex dielectric influences, enabling accurate descriptions of energy transfer involving plasmon polaritons and cavity photons. Third, we have established a unified electron transfer theory that bridges radiative and non-radiative processes, extending the Marcus theory and addressing its limitations, including the inverted region anomaly. Furthermore, we present novel mechanisms for non-adiabatic QED effects such as non-adiabatic emission and superradiance beyond the Dicke model, providing insights into QED-driven processes. These advancements link quantum optics and physical chemistry, offering powerful tools for experimental and theoretical exploration.

Time: May 29, Thu. 14:10 **Venue: PH2006**