Tailoring light-matter interactions based on quantum nanophotonics

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Tailoring light–matter interactions provides powerful means to control the photophysical properties of quantum emitters. In particular, nanophotonic control of these interactions through the modification of the electromagnetic environment is of great importance for developing novel photonic applications[1]. The optical interplay between active materials and nanocomposite structures has become a key strategy for tuning nonradiative processes associated with exciton dynamics. Such control not only enables precise manipulation of photophysical properties, but also opens up new conceptual platforms for engineering transition dipole moments. Consequently, the ability to tune, activate, and manipulate photophysical behavior via nonlocal interactions can drive advancements in sensing, integrated photonics, and optoelectronic devices. In this talk, I will present various experimental demonstrations and recent advances highlighting significant modifications of light-matter interactions including various photophysical processes and nonlinear optical properties in hybrid systems, as well as their potential applications [2-6].

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