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Accurate modeling of photodynamic processes enhanced by plasmonic nanoantennas CHRISTOS ARGYROPOULOS, University of Nebraska-Lincoln, GLEB AKSELROD, Duke University, CRISTIAN CIRACI, Istituto Italiano di Tecnologia, THANG HOANG, MAIKEN MIKKELSEN, DAVID SMITH, Duke University — Plasmonic nanoantennas are powerful platforms to enhance fluorescence and spontaneous emission rates leading to exciting nanophotonic applications. Strong fields confined in highly subwavelength regions in the nanoantenna geometry are ideal conditions to increase the Purcell factor. However, the accurate modeling of the interaction between fluorescence molecules or quantum-dots and plasmonic nanoantennas is a complicated task. In our talk, we will demonstrate efficient numerical techniques to accurately compute the total spontaneous emission rate and radiation efficiency by multiple fluorescence molecules and quantum-dots randomly positioned nearby the plasmonic nanoantennas [G. Akselrod, C. Argyropoulos et al., Nat. Phot. 8, 835-840 (2014)]. This is a complex problem because in plasmonic systems the Purcell factor has contributions from an increased radiative rate and from an increased nonradiative rate due to the inherent metallic losses. We will demonstrate ways to accurately compute the useful fraction of energy emitted as radiation, known as the radiative quantum yield. When we combine the knowledge of the Purcell factor and the quantum yield, the enhancement in the emitters' radiative rate can be computed, which consists the key property to obtain efficient ultrafast nanophotonic communication systems. The presented numerical results are in excellent agreement with experimental results obtained by similar nanoantenna systems.

Christos Argyropoulos
University of Nebraska-Lincoln

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