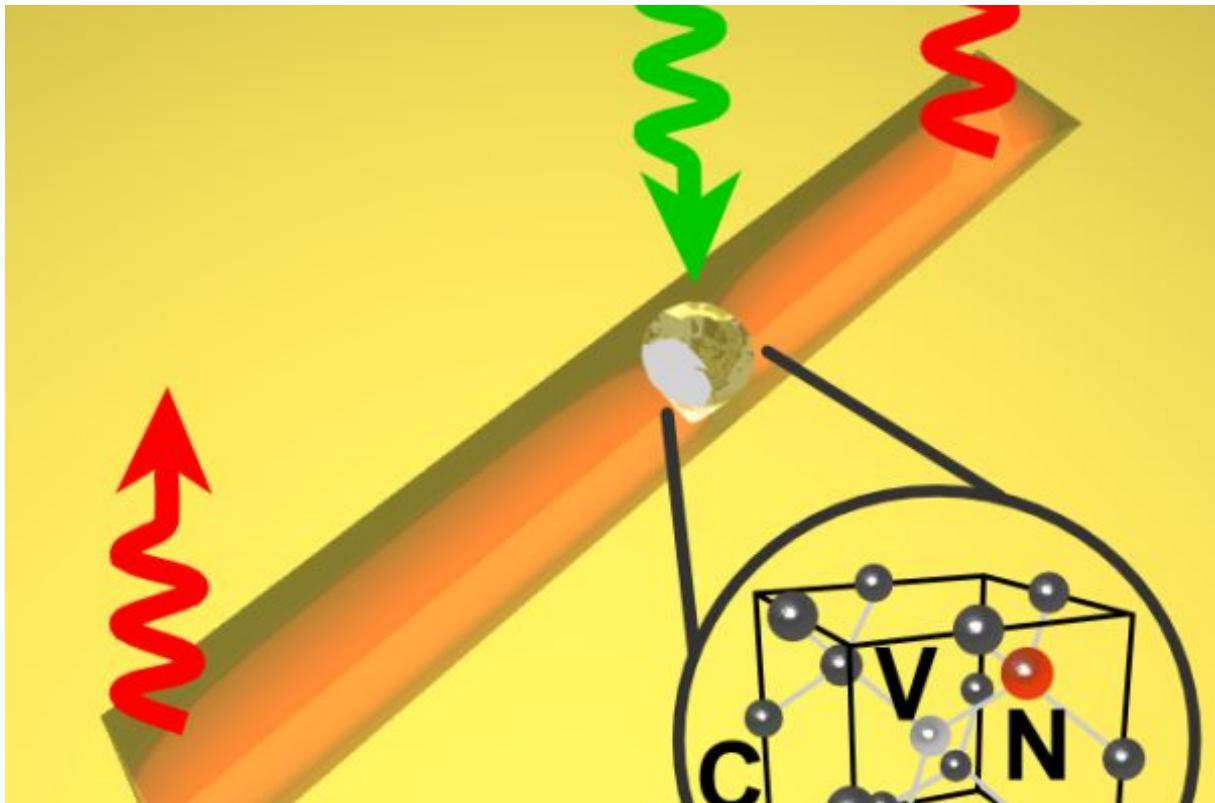




Coupling of artificial atoms to V-groove plasmonic waveguides

ICFO researchers report on deterministic coupling of single quantum emitters with channel plasmons

August 07, 2015

One of the main challenges in developing future nano-scale quantum photonic circuits is to manage combining on a single chip a single photon source, waveguides, modulators and detectors. An important milestone towards this ultimate goal is the deterministic coupling of a single quantum emitter to an integrated waveguide.

In this context, ICFO researchers Esteban Bermudez Urena, Michael Geiselmann and Renaud Marty, led by ICREA Prof. Romain Quidant, in collaboration with scientists from UAM in Madrid (Francisco J. Garcia Vidal's group), Denmark (Sergey Bozhevolnyi's group) and United Kingdom (Yuri Alaverdyan), have been able to demonstrate coupling of the emission of a single quantum emitter to channel plasmons polaritons (CPPs) supported by a V-shape

plasmonic waveguide. The study "Coupling of individual quantum emitters to channel plasmons", has been published recently in the journal Nature Communications.

In this work, the researchers first used theoretical simulations to study the behaviour of the coupling between a quantum emitter and the V-groove plasmonic channel. Once an optimal theoretical configuration was identified, they used state-of-the-art techniques to assemble the experiment using a single Nitrogen Vacancy (NV) centre, a single quantum emitter present in diamond, coupled to the CPPs supported by a V-groove (VG) channel. The observations obtained from the experiment revealed efficient coupling of the NV centre emission to the propagating modes of the VG, in accordance with the theoretical predictions postulated by the team. This demonstrates that their approach can enable realistic and functional plasmonic circuitry and therefore, paves the way towards the development of efficient and long distance transfer of energy in integrated solid-state quantum systems.