5. Supplementary materials

5.1. Chemicals

All chemicals were used as received. Tetraethylorthosilicate (TEOS, 98%), poly(ethylene glycol) p-(1,1,3,3-tetramethylbutyl)-phenyl ether (Triton X-100), 1-hexanol (99%), 1-vinylimidazole (99%), vinyltrimethoxysilane (98%), Toluene, 2,2-azobisisobutyronitrile (AIBN), chloroauric acid ($HAuCl_4$, 99.999%), tetrakis(hydroxymethyl)phosphonium chloride (THPC, 80% in H_2O), sodium hydroxide (97%), formaldehyde (CH_2O, 37 wt.% in H_2O), ammonium hydroxide (NH_4OH, 28.0-30.0 wt.% NH_3 inH2O), hydroxylamine hydrochloride ($NH_2OH{\bullet}HCl$, 99%) were purchased from Sigma- Aldrich. Potassium carbonate (K_2CO_3, >99%) was obtained from Fisher. Poly(vinylpyrrolidone) (PVP-K12, average MW ∼3500) was purchased from Acros Chemicals.

5.2. Complementary figures

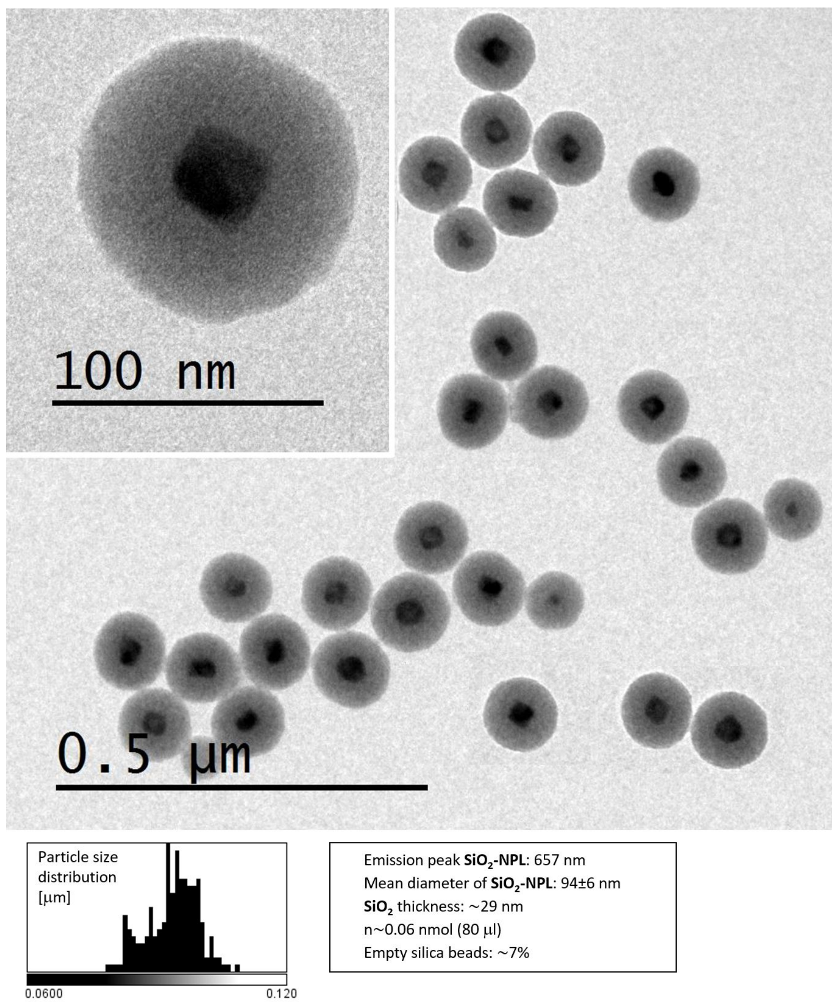

Fig. S 1: TEM images of SiO2-NPL nanoparticles and its size distribution. Statistical characteristics are provided.

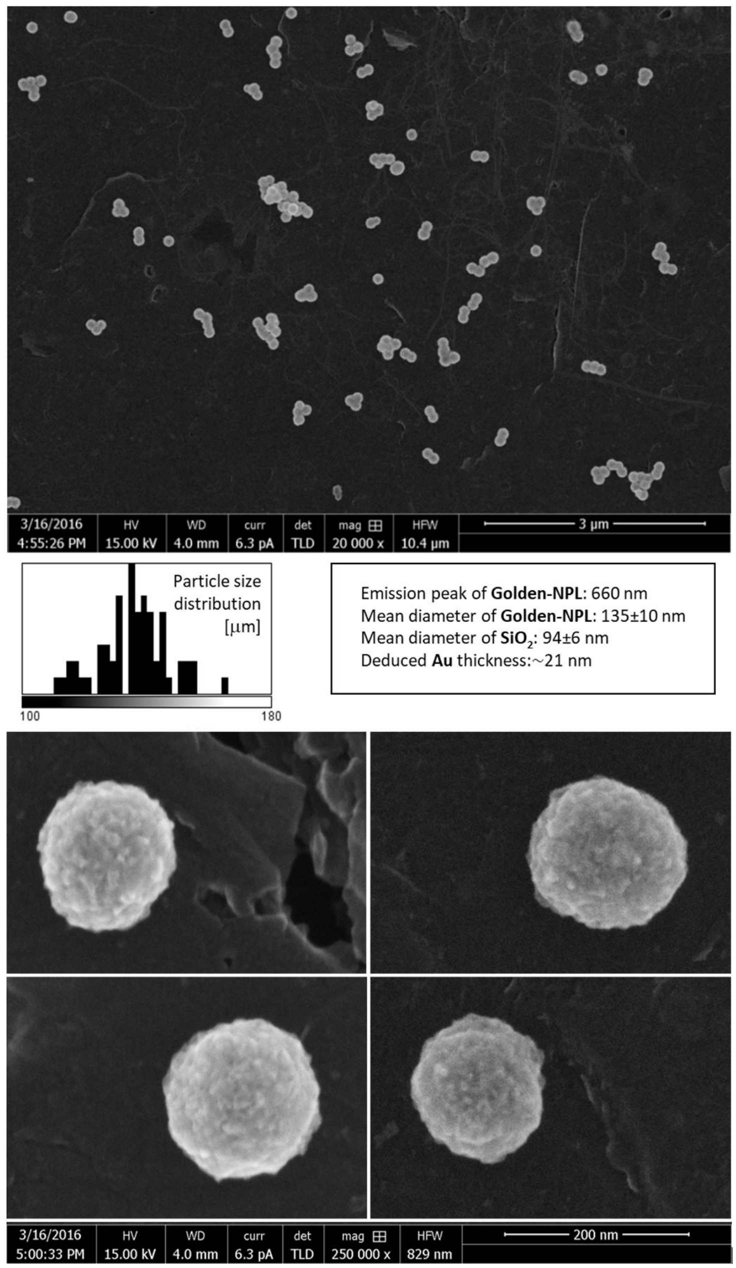

Fig. S 2: SEM images of Golden-NPL nanoparticles and its size distribution. Statistical characteristics are provided.

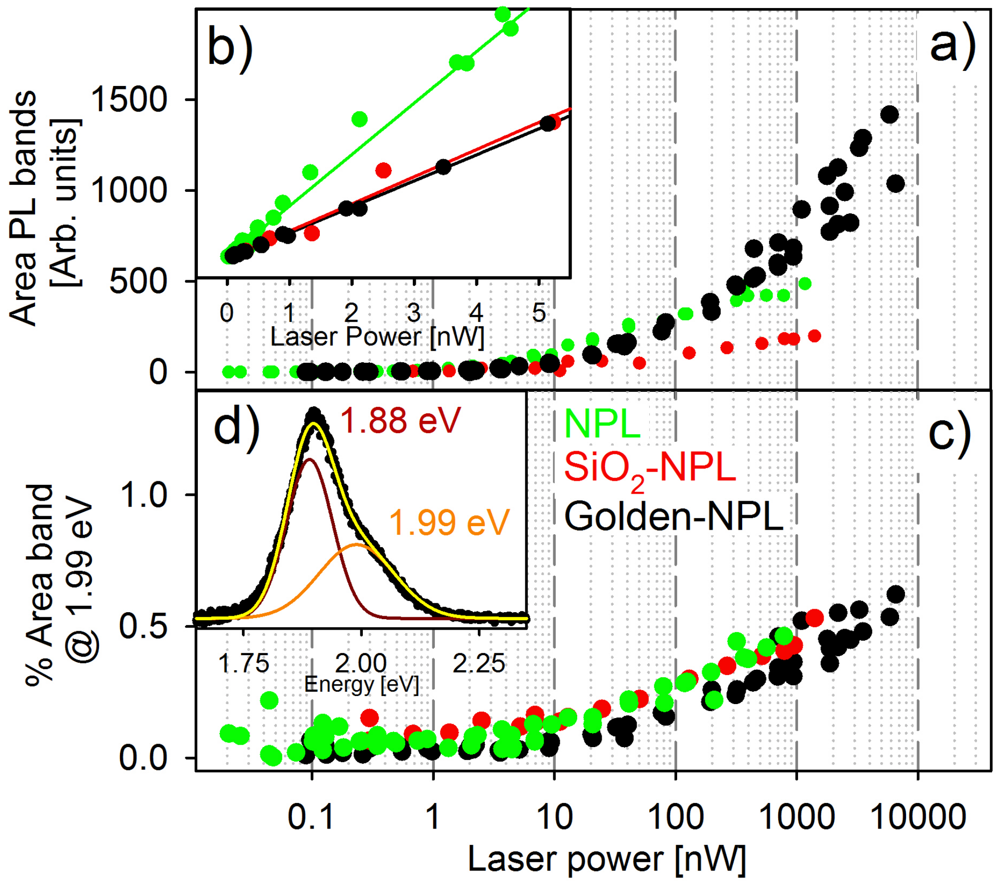

Fig. S 3: Emission band area of Bare-NPL (green), SiO_2-NPL (red) and Golden-NPL (black) as a function of laser power spanning over six orders of magnitude (10^{-2} to 10^4 nW).

a) The Integral of the measured spectra without wavelength discrimination. Excitation power in log-scale.

b) Zoom of the values of the diagram a) in low power regime. Excitation power in linear-scale.

c) Ratio of the 1.99 eV band area (orange) to the total fluorescence area.

d) Typical bi-Gaussian fitting of the two bands at an excitation power of a few hundred nanowatts.

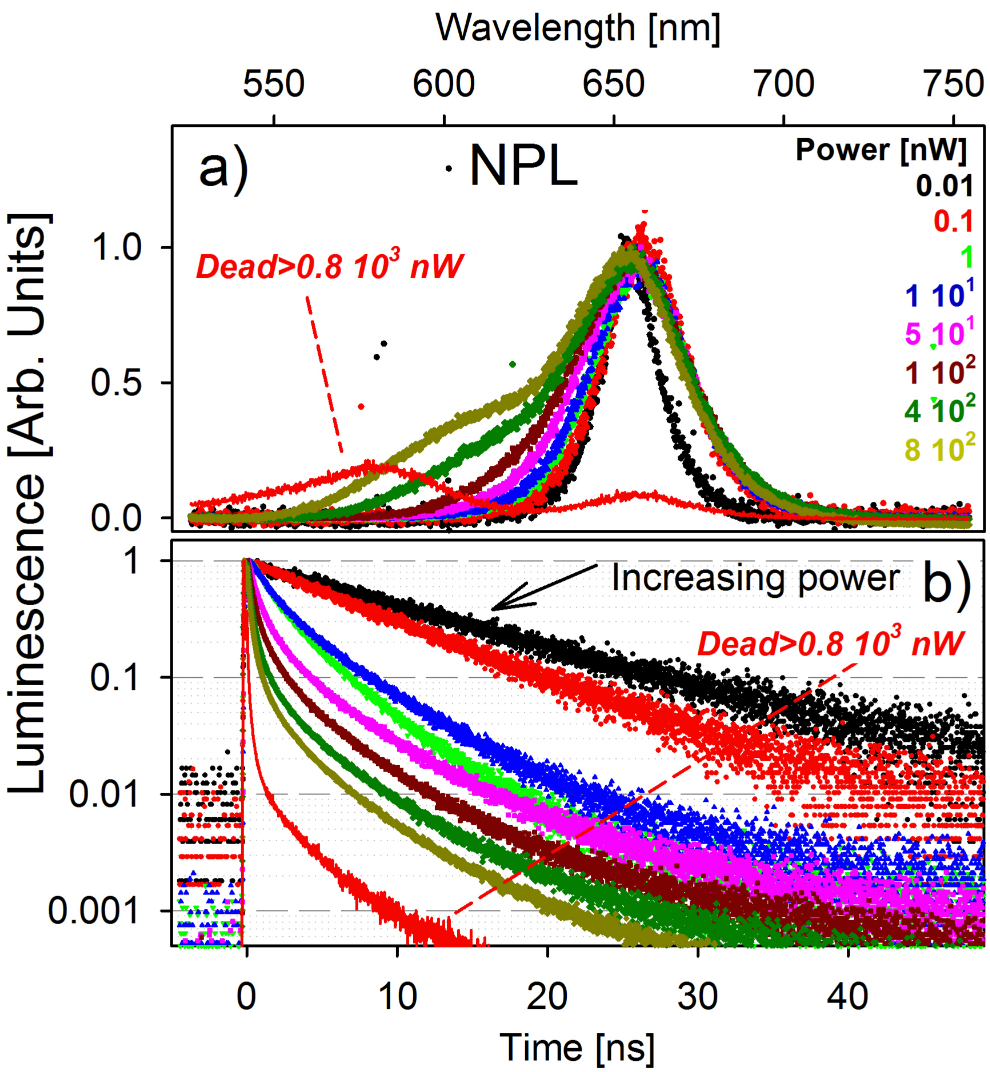

Fig. S 4: Panel-a: Emission spectra of single Bare-NPL emitter as a function of laser power. Excitation values are provided on the right side of the panel. The breakdown power is indicated on associated spectrum in red. Panel-b: Corresponding emission decays at different laser power captioned on Panel-a. The decay associated to breakdown power is figured out in red.

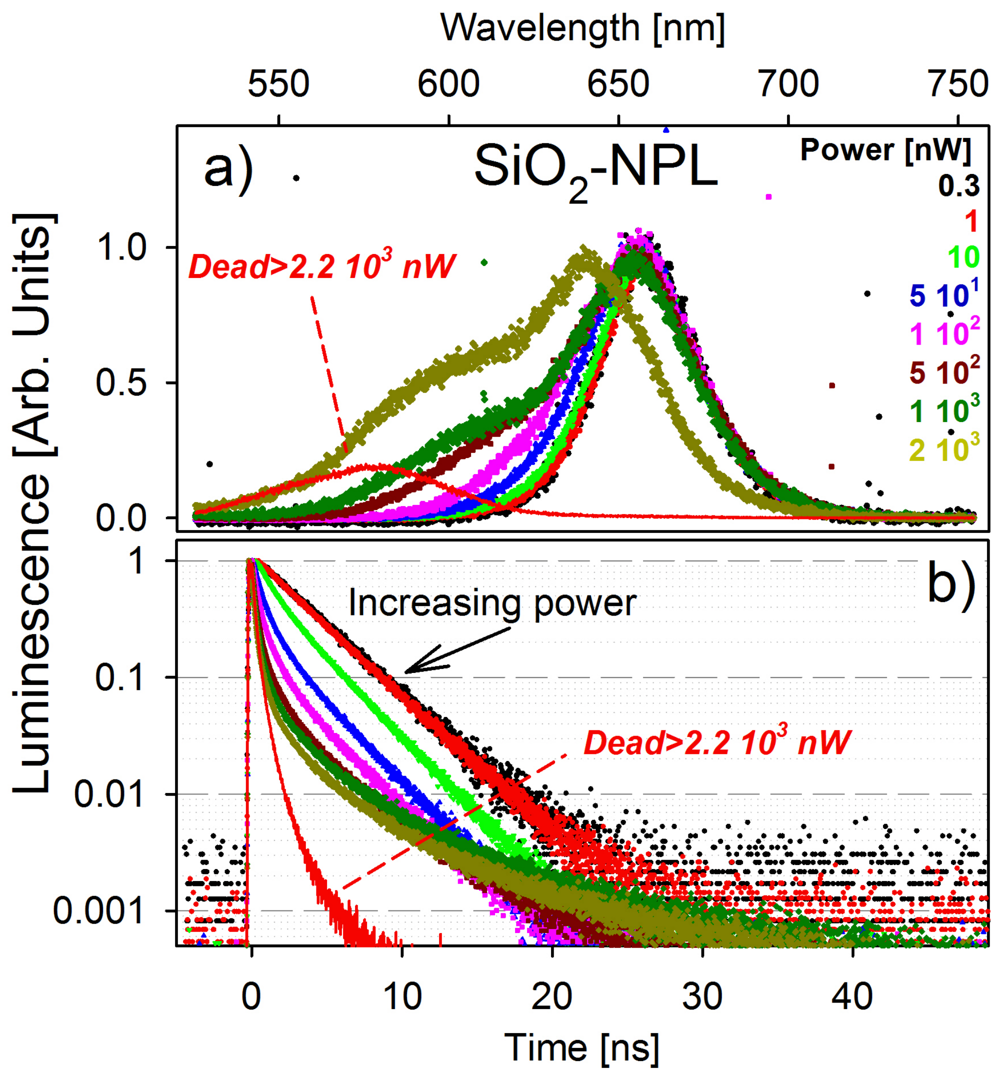

Fig. S 5: Panel-a: Emission spectra of single SiO_2-NPL emitter as a function of laser power. Excitation values are provided on the right side of the panel. The breakdown power is indicated on associated spectrum in red. Panel-b: Corresponding emission decays at different laser power captioned on Panel-a. The decay associated to breakdown power is figured out in red.

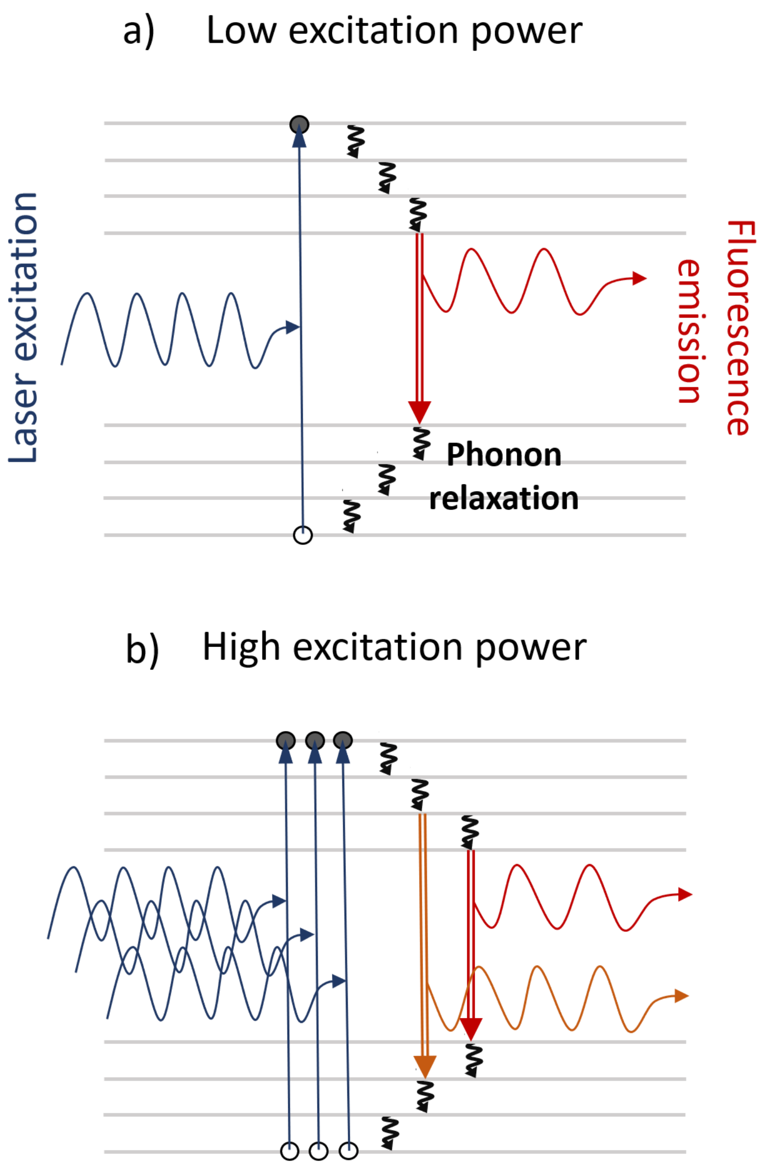

Fig. S 6: Illustration of possible radiative exciton transitions, at low (a) and high (b) optical excitation power, for an excitation energy greater than the material's gap band. Both standard red and orange band recombinations are shown with straight arrows which colors are associated with their emission band. The small ondulated arrows represent phonons coupled relaxations.