Supplementary Information for

Spontaneous Emission in Nonlocal Materials

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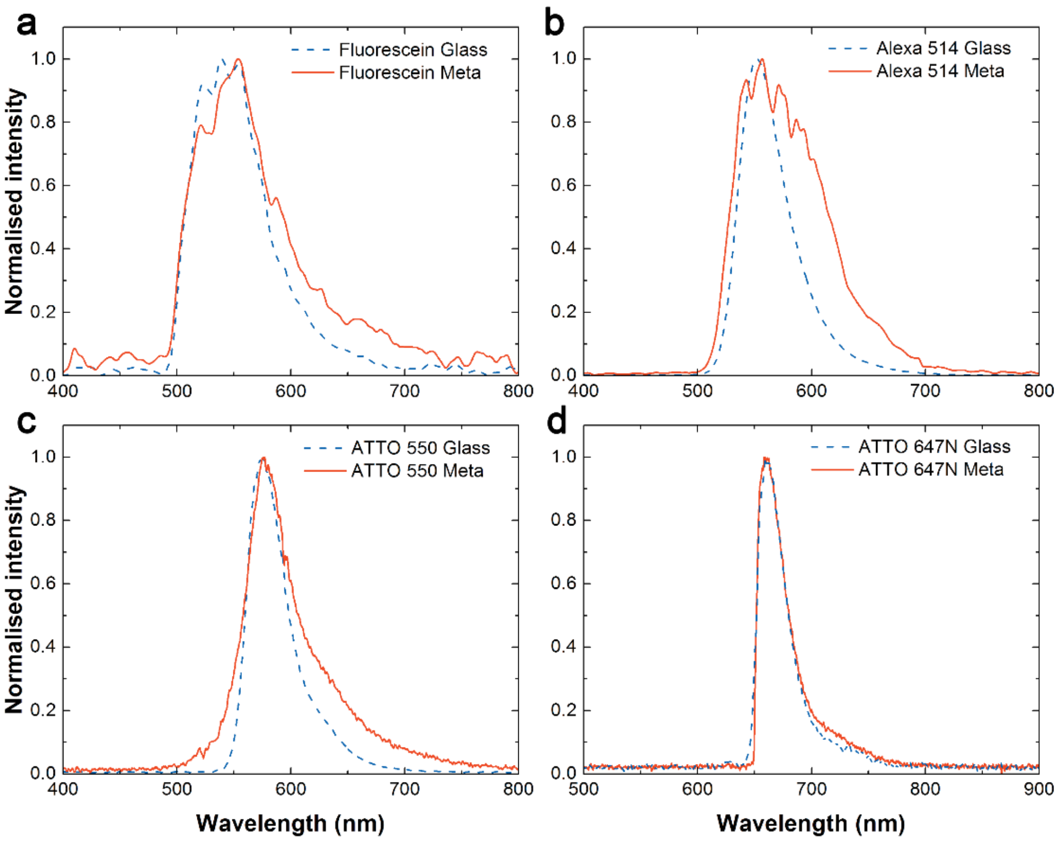

Figure S1. Emission spectra measured on glass (blue) and inside the metamaterial (red): (a) D1: Fluorescein, (b) D2: Alexa 514, (c) D3: ATTO 550, and (d) D4: ATTO 647N.

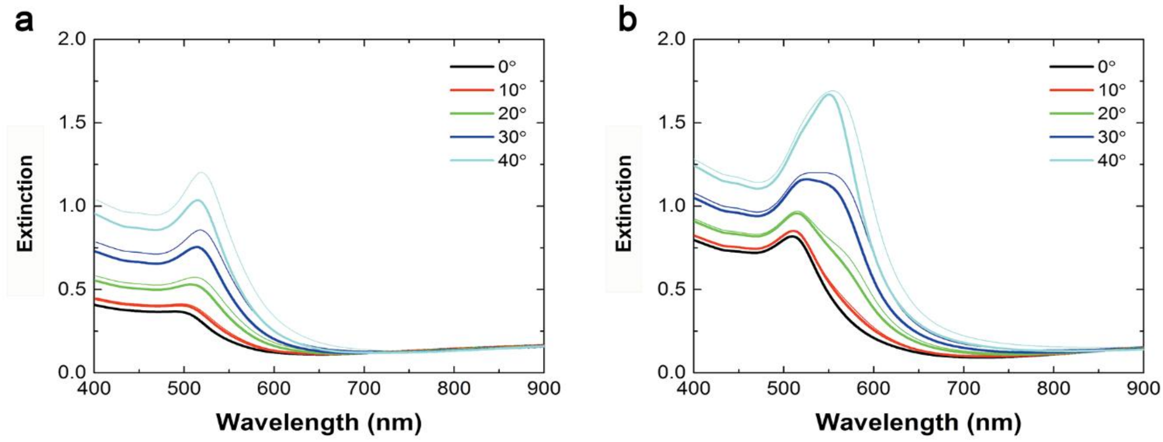

Figure S2. Extinction spectra of the nanorod metamaterial studied in the experiment for different angles of incidence in (a) air and (b) ethanol calculated using (thick lines) nonlocal and (thin lines) local effective medium theories.

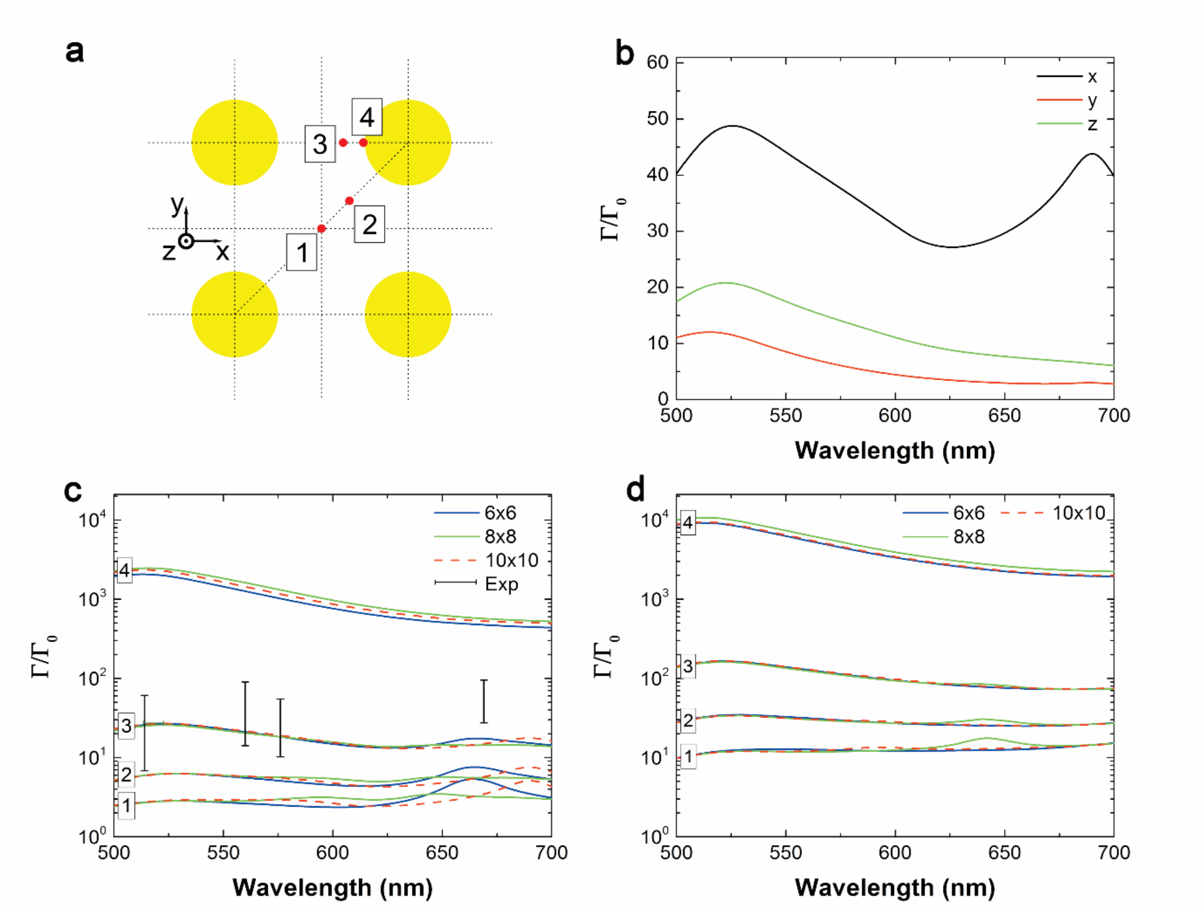

Figure S3. Numerical simulations of the spontaneous emission rate in metamaterials. (a) Schematic of the metamaterial with the position of the emitters used in the simulations. All the emitters are situated in the middle of the nanorod length. (b,c,d) Spectral dependence of the emission rate for (b) a dipole with different orientations at position 3 inside the metamaterial, (c,d) a randomly oriented dipole at different positions inside the nanorod metamaterial (as indicated in a) for the metamaterials with (b,c) period $a = 100$ nm and nanorod radius r = 25 nm (as in the experiment) and (d) a = 50 nm and r = 12.5 nm, corresponding to the same local effective medium parameters. The colored lines correspond to different sizes of the finite nanorod array used in the simulations (as indicated in the legends) showing the convergence to the behavior of the infinite metamaterial; bars in (c) represent the experimental data corresponding to the width of the lifetime distribution at 10% of the modal amplitude (Fig. 5). In all simulations the internal quantum yield of the emitter was considered to be 1.

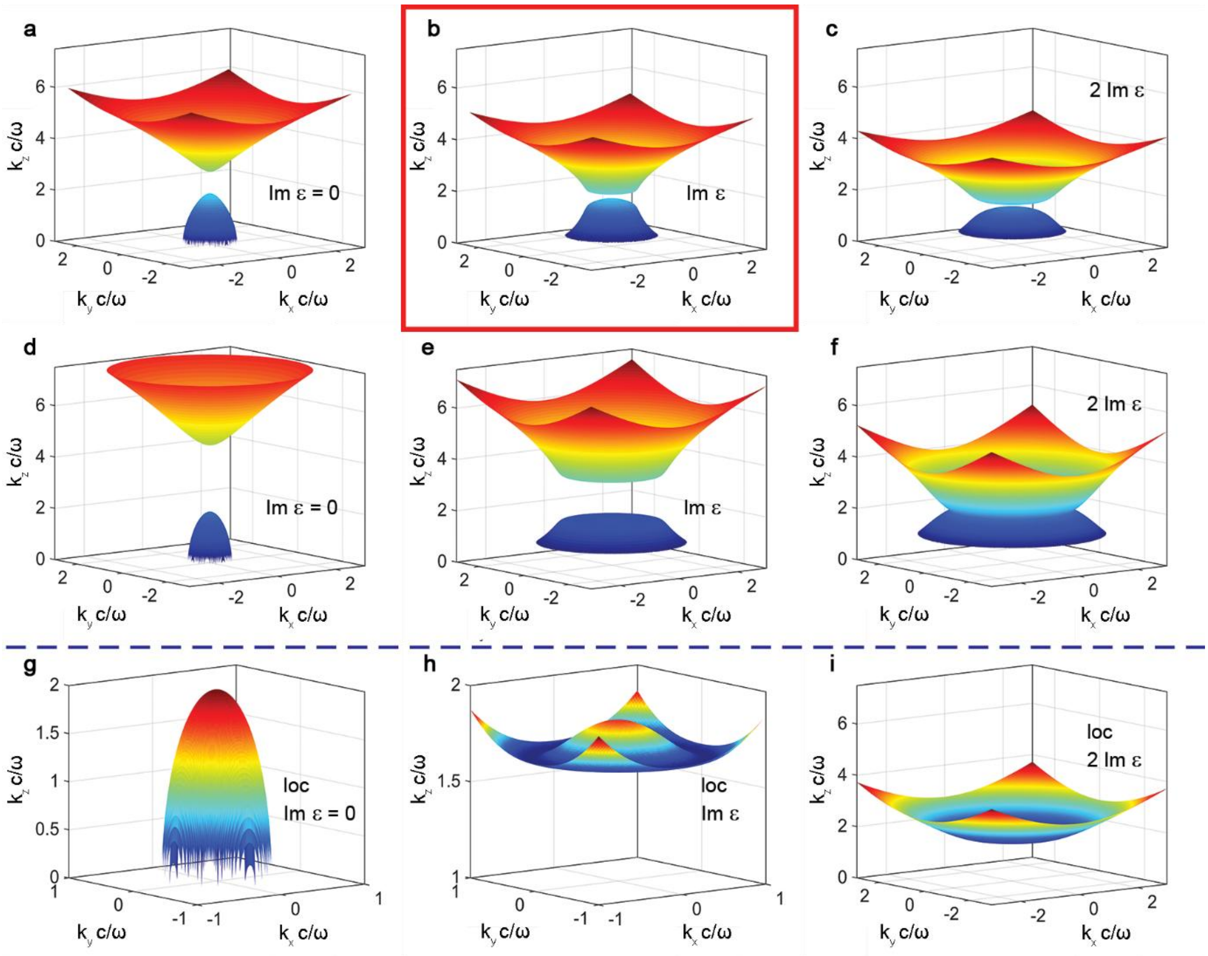

Figure S4. Dispersion of TM-polarized modes supported by nanorod composites in the elliptical regime ($\lambda = 550\ \mathrm{nm}$) for different material absorption and geometry: (a,d,g) hypothetical loss-less metamaterial, (b,e,h) absorption as in the experiment, (c,f,i) twice larger absorption than in (b,e,h); (a-f) nonlocal effective medium theory for metamaterials with (a-c) $a = 100\ \mathrm{nm}, r = 25\ \mathrm{nm}$ as in the experiment and (d-f) 50% unit cell ($a = 50\ \mathrm{nm}, r = 12.5\ \mathrm{nm}$), (g-i) local effective medium theory. The solid box (b) highlights the dispersion of the modes in the metamaterial used in the experiment. The dashed line separates nonlocal and local EMT results.

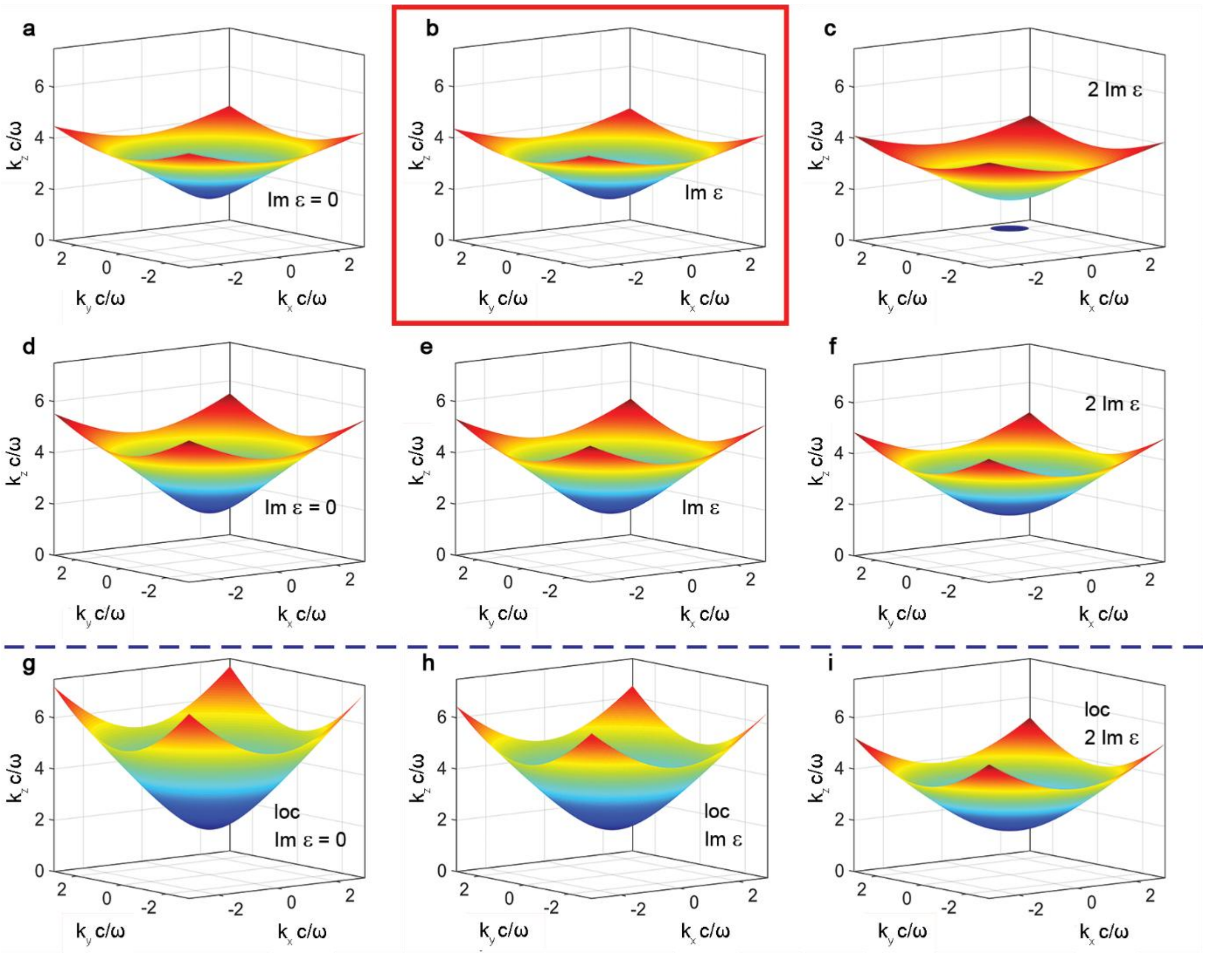

Figure S5. Dispersion of TM-polarized modes supported by nanorod composites in the hyperbolic regime ($\lambda = 650\ \mathrm{nm}$) for different material absorption and geometry: (a,d,g) hypothetical loss-less metamaterial, (b,e,h) absorption as in the experiment, (c,f,i) twice larger absorption than in (b,e,h); (a-f) nonlocal effective medium theory for metamaterials with (a-c) $a = 100\ \mathrm{nm}, r = 25\ \mathrm{nm}$ as in the experiment and (d-f) 50% unit unit cell ($a = 50\ \mathrm{nm}, r = 12.5\ \mathrm{nm}$), (g-i) local effective medium theory. The solid box (b) highlights the dispersion of the modes in the metamaterial used in the experiment. The dashed line separates nonlocal and local EMT results.

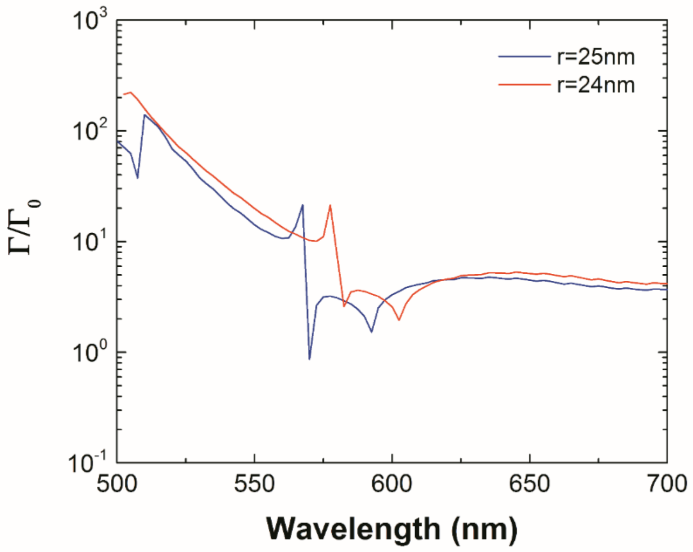

Figure S6. The emission rate modification simulated with the nonlocal effective medium theory for different geometrical parameters of the metamaterial: (blue line) 50 nm nanorod diameter, (red line) 48 nm nanorod diameter. The parameters were varied near the nominal parameters of the metamaterial studied in the experiment to illustrate stability of the lifetime modifications with respect to possible experimental variations in the geometry and properties of materials.