Supporting Information

Stochastic Photon Emission from Non-blinking Upconversion Nanoparticles

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UCNPs characterization.

The shape, size, and uniformity of the synthesized UCNPs were assessed by transmission electron microscopy (Tecnai G2 F30 S-Twin, Fei). The XRD pattern of UCNPs was obtained with the X-ray diffractometer (SmartLab, RIGAKU). The emission spectra of the UCNPs were measured with a spectrometer (HR 2000+ , Ocean Optics).

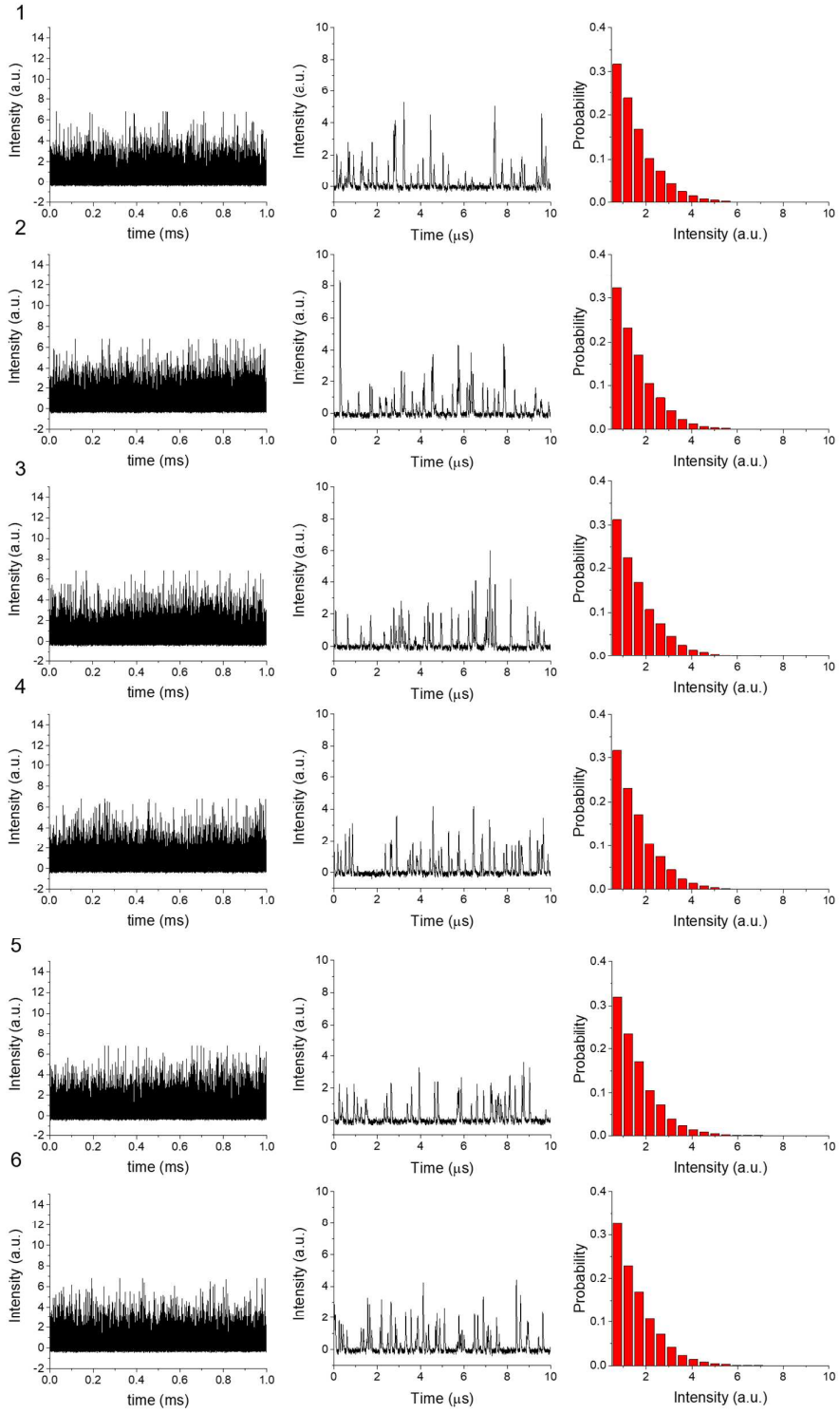

Figure S1. Time traces at different timescale (left: 0 - 1 ms and right: 0 - 10 μs) and intensity histograms. These time traces and intensity histograms were obtained in the same conditions as Figure 2b and all the data were reproducible.

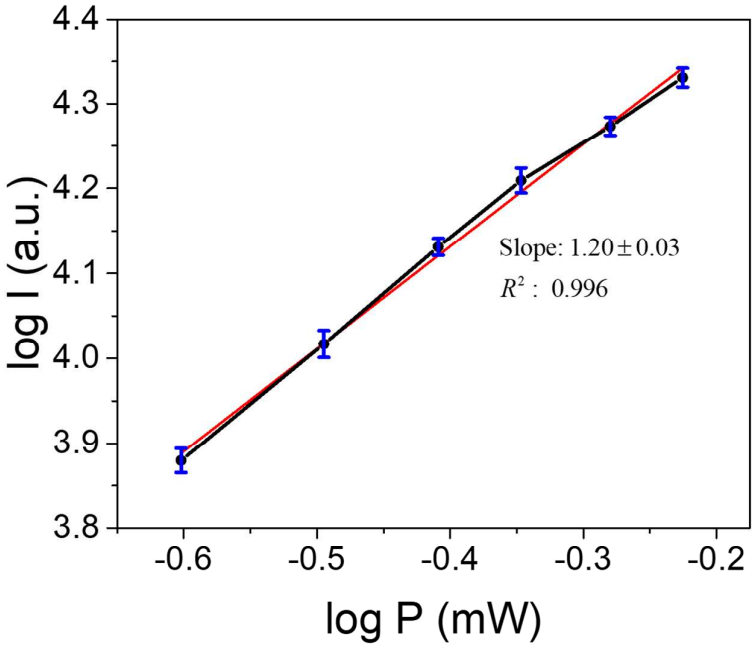

Figure S2. The log-log plot of the emission intensity from UCNPs as a function of excitation power. In this log-log plots for UCNPs emission, the slopes lie between 1 and 2. The error bars represent standard deviations.

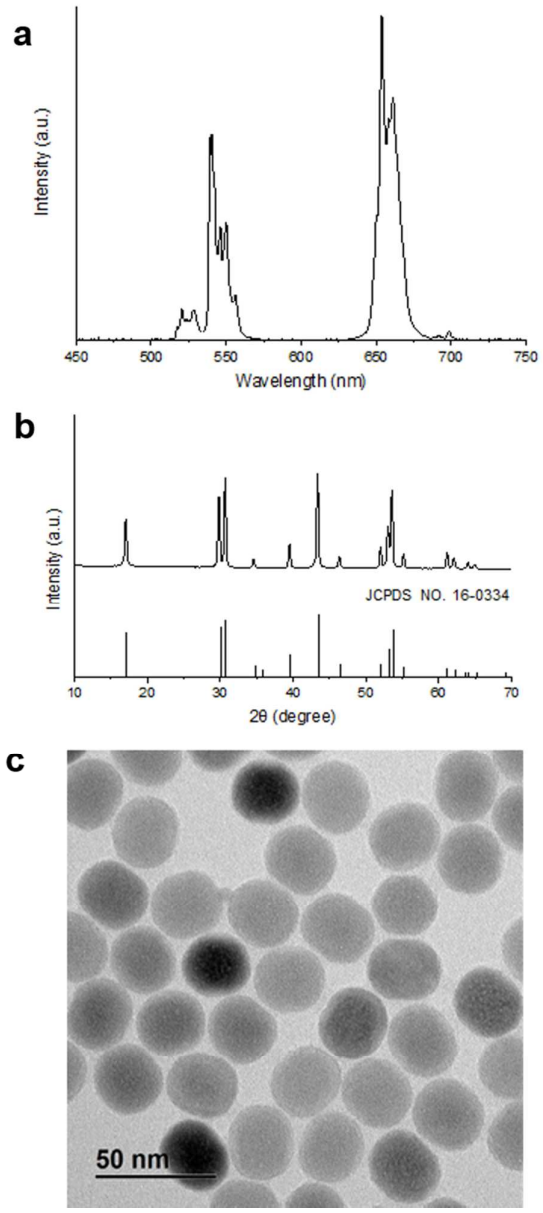

Figure S3. (a) Emission spectrum, (b) XRD pattern, and (c) TEM image of the UCNPs ($NaYF_4$:Yb^{3+},Er^{3+}/$NaYF_4$).

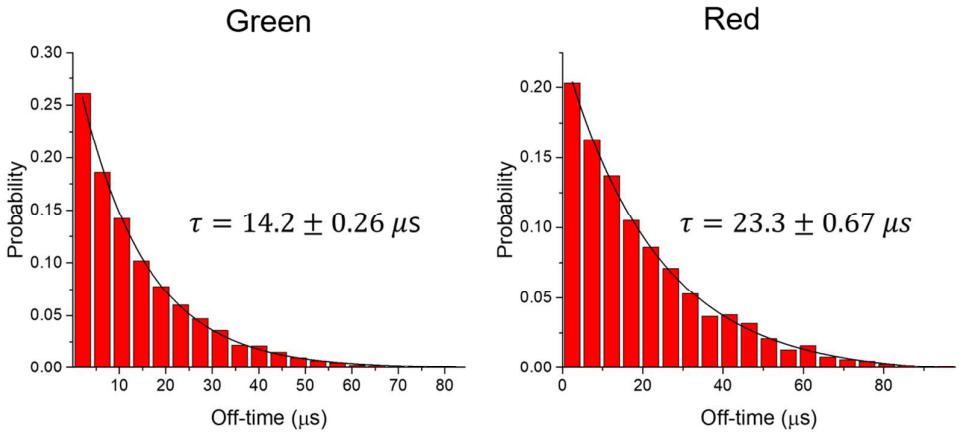

Figure S4. Off-time histograms of the time trace in Fig. 3b at an excitation power 0.2 mW. The off-time in each emission band increases as the excitation power decreases.