Supporting information

Quantitative Determination of Dark Chromophore Population Explains the Apparent Low Quantum Yield of Red Fluorescent Proteins

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Present Addresses

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S1: We find single exponential decays for all four studied red emitting fluorescent proteins, confirming the presence of only a single relevant emitting species. Clear differences in the recorded fluorescence lifetime between the studied proteins are visible. Introducing the LDOS modifying probe did not change the single exponential decay of all three studied proteins (see figure S1, below).

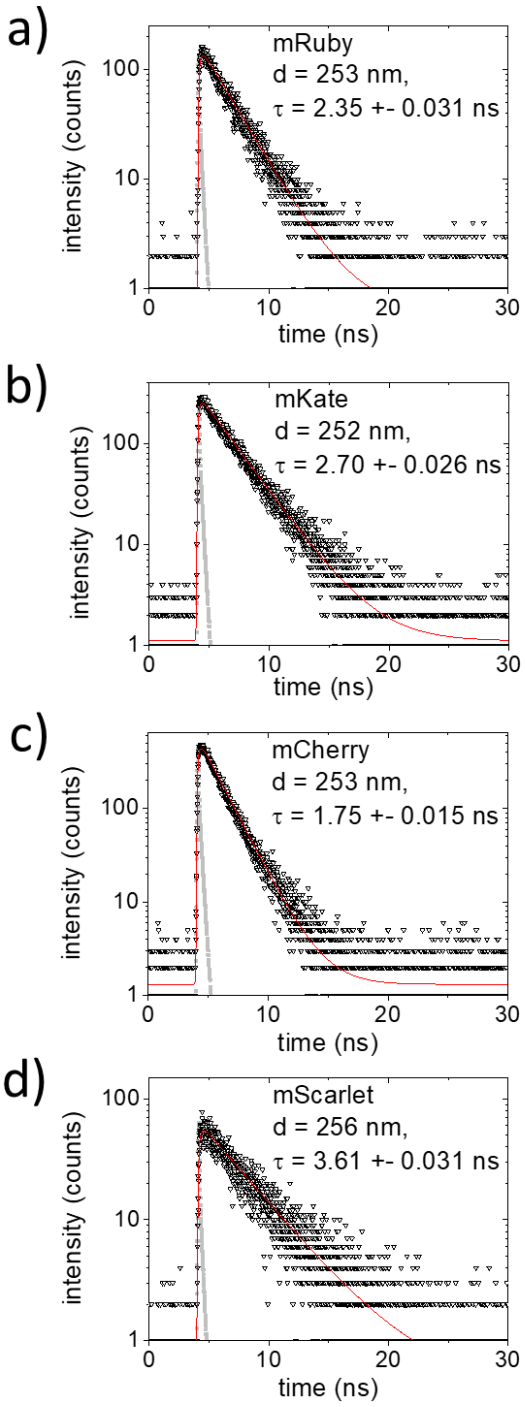

Figure S1: Exemplary decays measured for the four studied fluorescent proteins with the LDOS manipulating probe at distances of about 250 nm from the fluorophores. Grey squares: instrument response function (IRF), open triangles: measured data, red lines: single exponential fit to measured decay.

S2: The modeled fluorescence lifetime shows good agreement with the measured data starting from a sample to mirror distance of 100 nm. At smaller distances we see deviations, the model does not produce the measured lifetimes. The reason for the failure of the model at such short distances is unknown, but the observation appears to agree with reports from other groups[1, 2]. For the analysis data starting at sample to mirror distance of 100 nm was included.

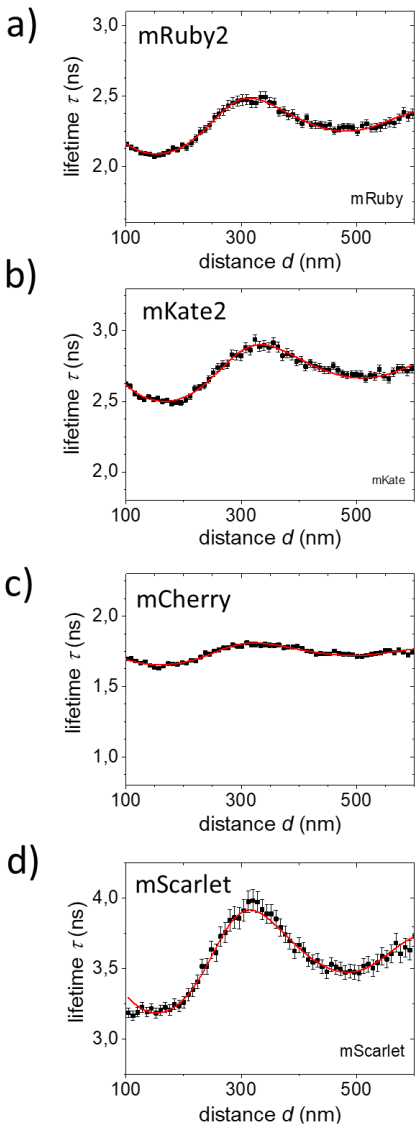

Figure S2: Fluorescent lifetime versus fluorophore-to-mirror distance. The data recorded (black squares) show very good agreement to the fits using the single mirror model (red lines) for all four red fluorescent proteins.

References

1. Kwadrin, A.; Koenderink, A. F., Gray-Tone Lithography Implementation of Drexhage's Method for Calibrating Radiative and Nonradiative Decay Constants of Fluorophores. *J. Phys. Chem. C* **2012,** *116*, 16666-16673.
2. Stobbe, S.; Johansen, J.; Kristensen, P. T.; Hvam, J. M.; Lodahl, P., Frequency Dependence of the Radiative Decay Rate of Excitons in Self-Assembled Quantum Dots: Experiment and Theory. *Phys. Rev. B* **2009,** *80*, 155307.