Supporting information
Excited state interactions between the chiral $Au_{38}L_{24}$ cluster and covalently attached porphyrin

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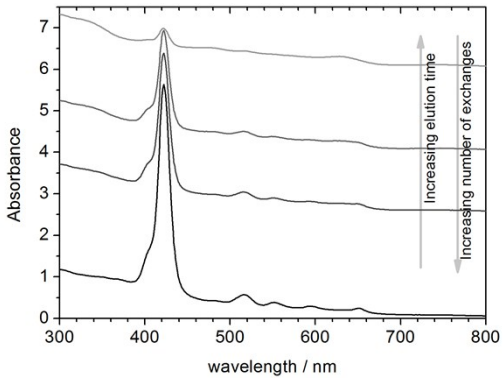

Fig. S 1: UV-vis spectra (normalized to 350 nm) of fractions separated by size exclusion chromatography. Ligand-exchanged clusters elute first, due to the significant increase in size when the large porphyrin (relative to the clusters size) is attached.

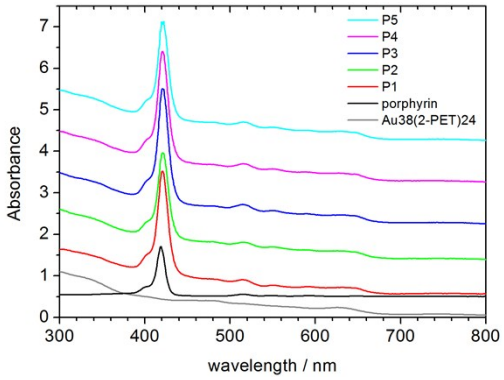

Fig. S 2: UV-vis spectra (normalized to 350 nm and shifted for clarity) of HPLC isolated fractions. All spectra show the same features of porphyrin and $Au_{38}L_{24}$ absorption bands.

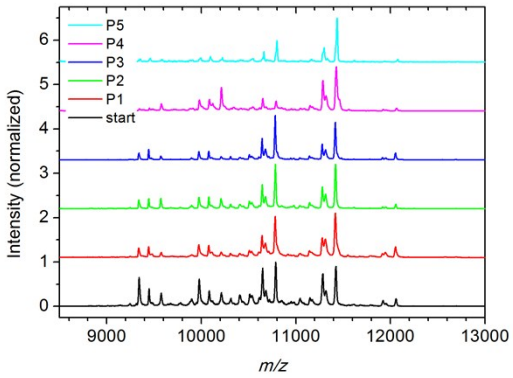

Fig. S 3: MALDI spectra from HPLC collected samples show non-exchanged (*m/z* = 10778), mono- (*m/z* = 11413) and small amounts of biexchanged (*m/z* = 12048) clusters

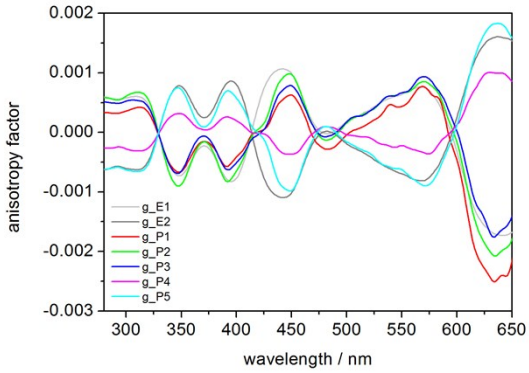

Fig. S 4: Calculated anisotropy factor ($g=\Delta A/A$) for the fraction separated by HPLC. The value lies in the same order of magnitude as for pure enantioseparated $Au_{38}(2PET)_{24}$.

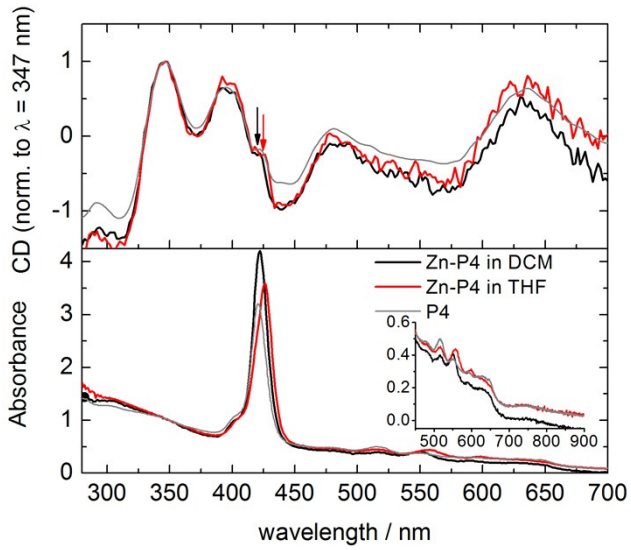

Fig. S 5: UV-vis and CD spectra of fraction P4 after Zn^{2+} incorporation measured in dichloromethane (DCM) and tetrahydrofurane (THF).

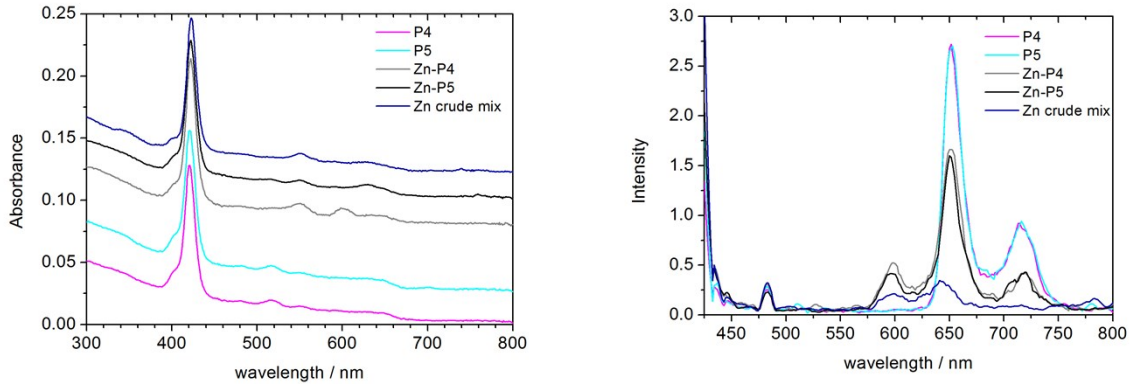

Fig. S 6: Fluorescence and absorption spectra of fractions P4 and P5 after incorporation of Zn. A typical blue shift of the emission bands is observed.

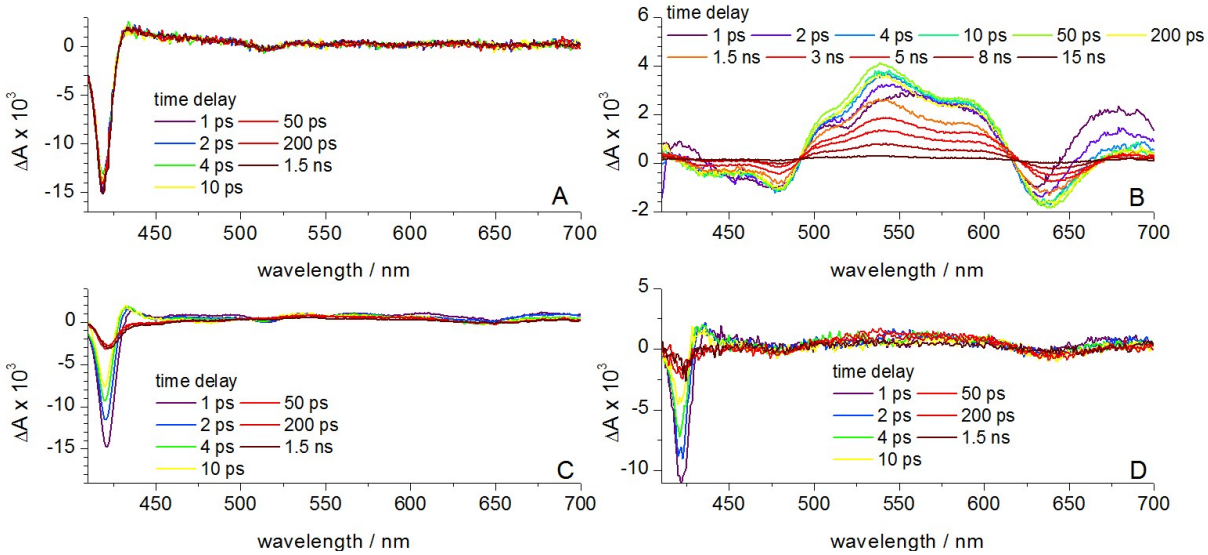

Fig. S 7: Transient absorption spectra of (A) free base porphyrin, (B) $Au_{38}(2PET)_{24}$, (C) $Au_{38}(2PET)_{24-n}(porphyrin)_n$ (n = 0-2) and (D) $Au_{38}(2PET)_{24n}(Zn\text{-}porphyrin)_n$ (n = 0-2) in DCM. Spectra 1 ps to 1.5 ns were measured after excitation at 400 nm while for the spectra 3 ns to 15 ns an excitation wavelength 355 nm was used.

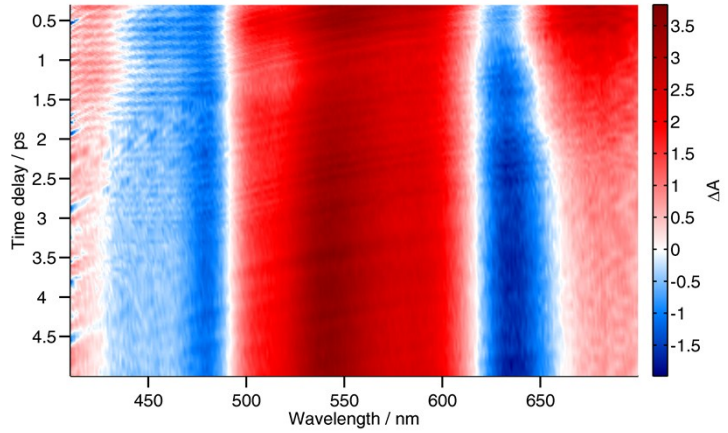

Fig. S 8: 2D map of the transient absorption data measured with $Au_{38}(2PET)_{24-n}(porphyrin)_n$ (n = 0-2) in DCM.

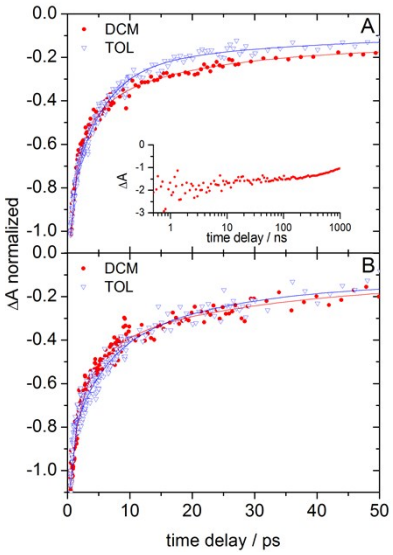

Fig. S 9: Temporal evolution of the Soret band ground-state bleach (averaged between 420 and 422 nm) for $Au_{38}(2PET)_{24-n}(porphyrin)_n$ (n = 0-2) (A) and $Au_{38}(2PET)_{24-n}(Zn\text{-}porphyrin)_n$ (n = 0-2) (B) measured upon 400 nm excitation. Solid lines are fit to the data. The inset in (A) shows the evolution on a longer time scale, in DCM, measured upon 532 nm excitation.

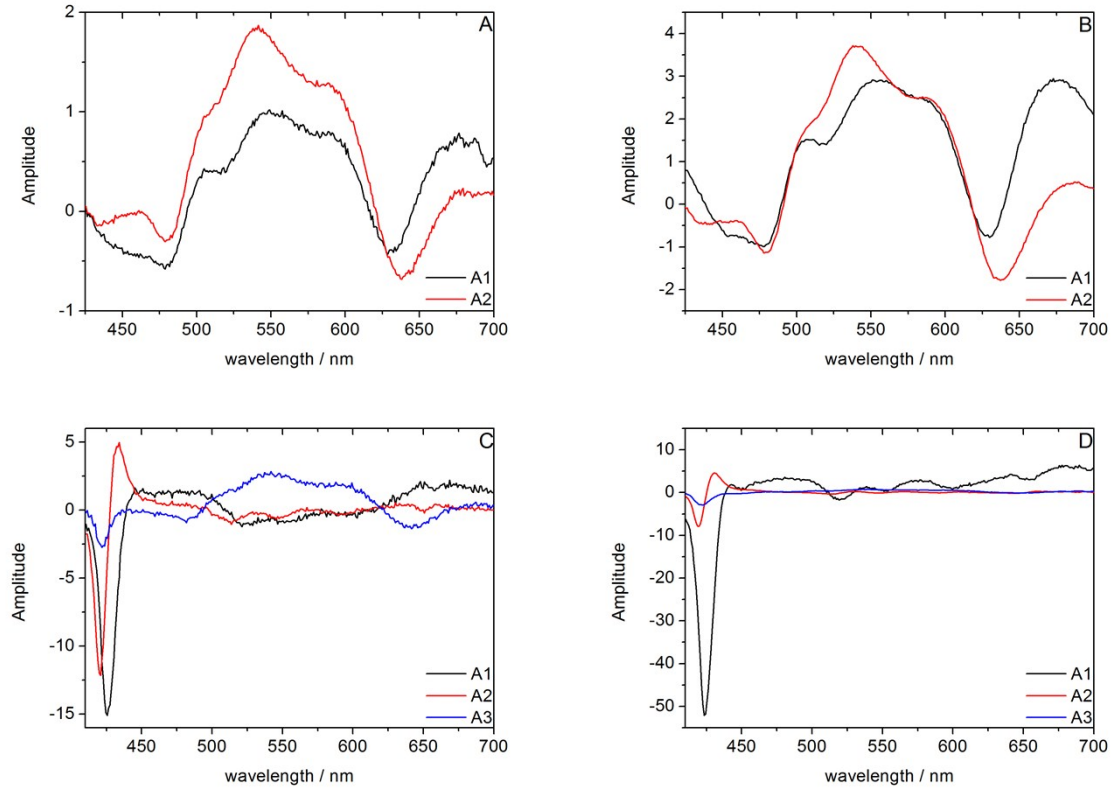

Fig. S 10: Decay-associated difference spectra obtained from the global analysis of the TA spectra A (B) $Au_{38}(2PET)_{24}$ in toluene (dichloromethane) and C (D) porphyrin functionalized cluster in toluene (dichloromethane).