

Our Journey to Molecular Single Photon Sources – Fast and Bright... but still Dark!

Andreas Steffen

Department of Chemistry and Chemical Biology, TU Dortmund University, Otto-Hahn-Str. 6, 44227 Dortmund, Germany. andreas.steffen@tu-dortmund.de

Abstract:

Emitter materials that can exploit triplet excitons in the near-IR are of interest due to their potential application in quantum information networks, device technologies and encryption schemes. One of the biggest challenges for the design of suitable metal complexes for these purposes is the enhanced non-radiative decay of low energy states due to the energy gap law. In this presentation we will show our efforts to improve the relative radiative (k_r) and non-radiative (k_{nr}) rate constants of Cu^I and Zn^{II} based TADF emitters for high quantum yields ϕ for emission beyond 600 nm in order to provide molecular single photon sources. Part of the strategy is the invention of paracyclophane based carbene ligands as π -chromophore ligands, giving k_r up to $2 \cdot 10^6 \text{ s}^{-1}$ and $\phi = 0.8$ for deep red to near-IR emission from copper(I) complexes. Bearing in mind that many IT relevant applications require circularly polarized emission (CPL), we have also investigated design criteria to maximize the dissymmetry in the excited states up to $g_{lum} = \pm 0.023$ for application in CP-OLEDs.