

# Features of Exciton Self-Trapping in J-Aggregates under Exciton–Plasmon Interaction

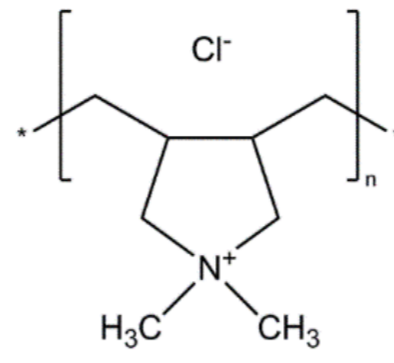
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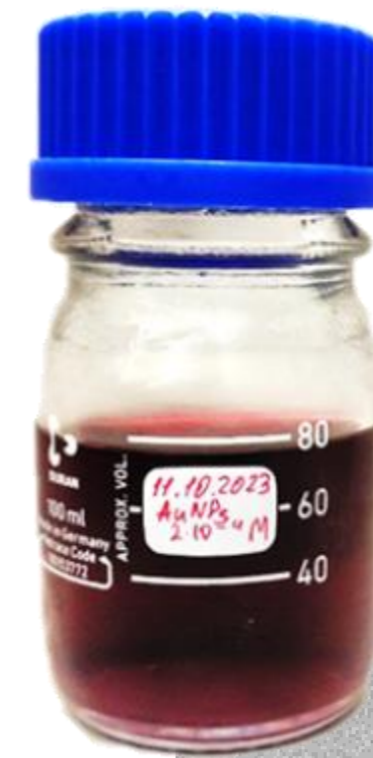


## Introduction

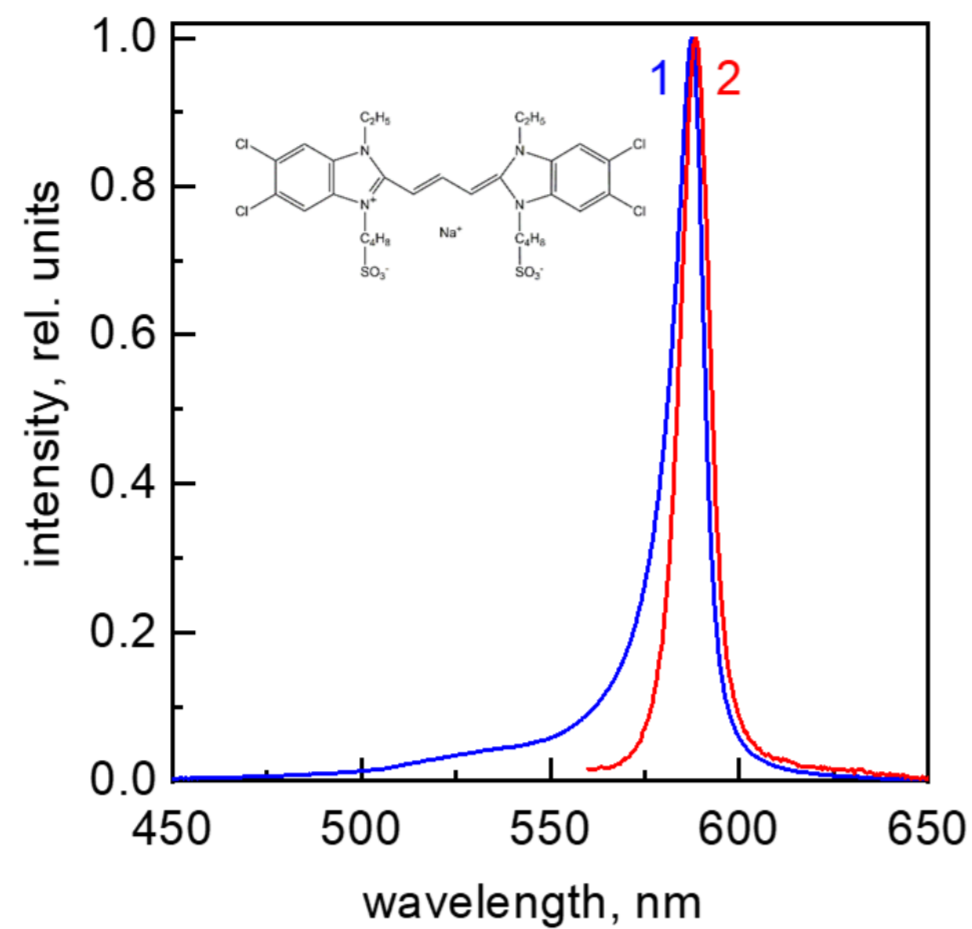
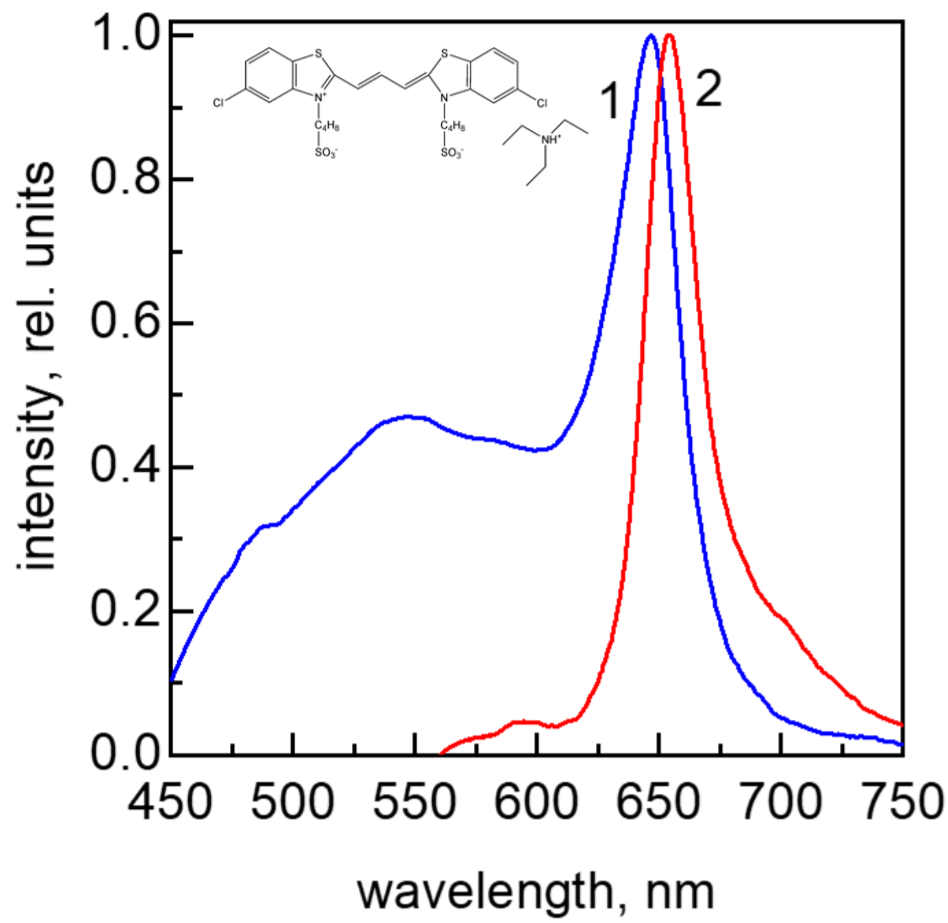
This study investigates the amplification luminescence for J-aggregates of different carbocyanine dyes, namely TCC (3,3'-disulfobutyl-5,5'-dichlorothiacarbocyanine triethyl-ammonium salt) and TDBC (1,1'-disulfobutyl-3,3'-diethyl-5,5',6,6'-tetrachloro-benzimidazolylcarbocyanine sodium salt), in thin polymer films, formed by polycation PDDA (poly(diallyldimethylammonium chloride)), by strategically positioning them at a specific distance from a layer of gold nanoparticles.



PDDA



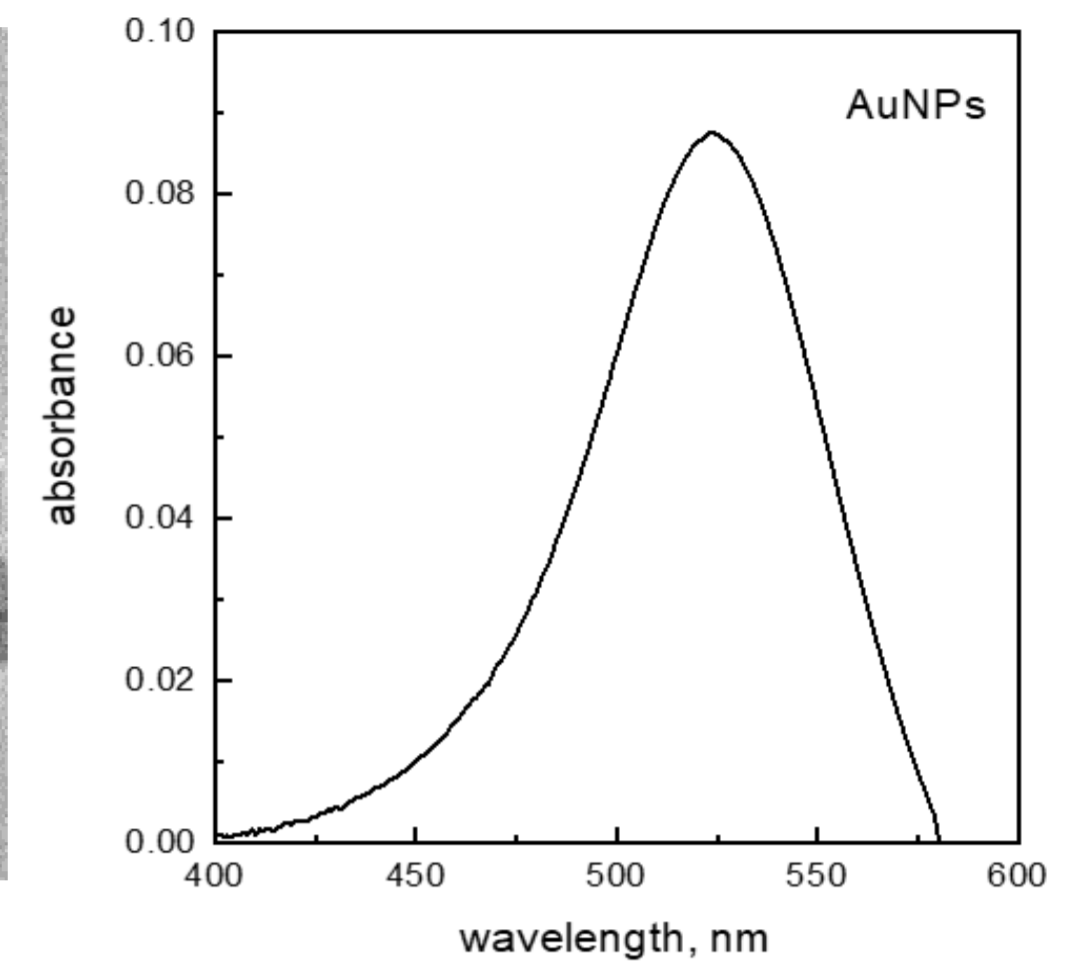
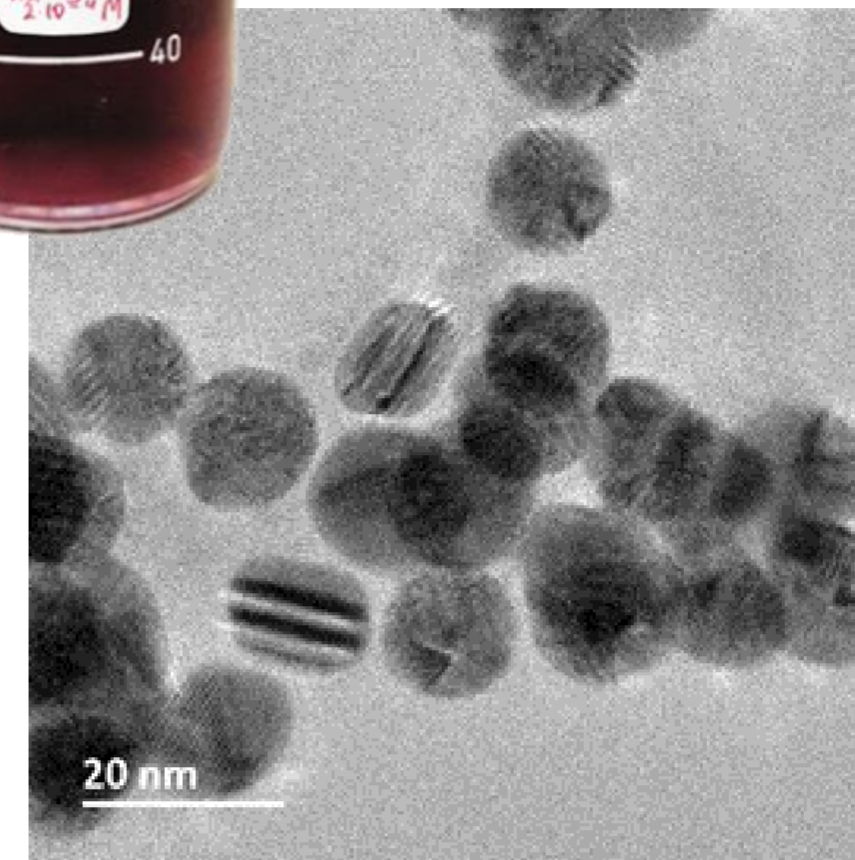
Gold nanoparticles were synthesized using the well-known Turkevich method of water based reduction of gold salt by trisodium citrate.



Absorption (1) and luminescence (2,  $\lambda_{exc} = 530$  nm) spectra of TCC (left) and TDBC (right) J-aggregates in a polymer film (spectra are normalized for clarity).

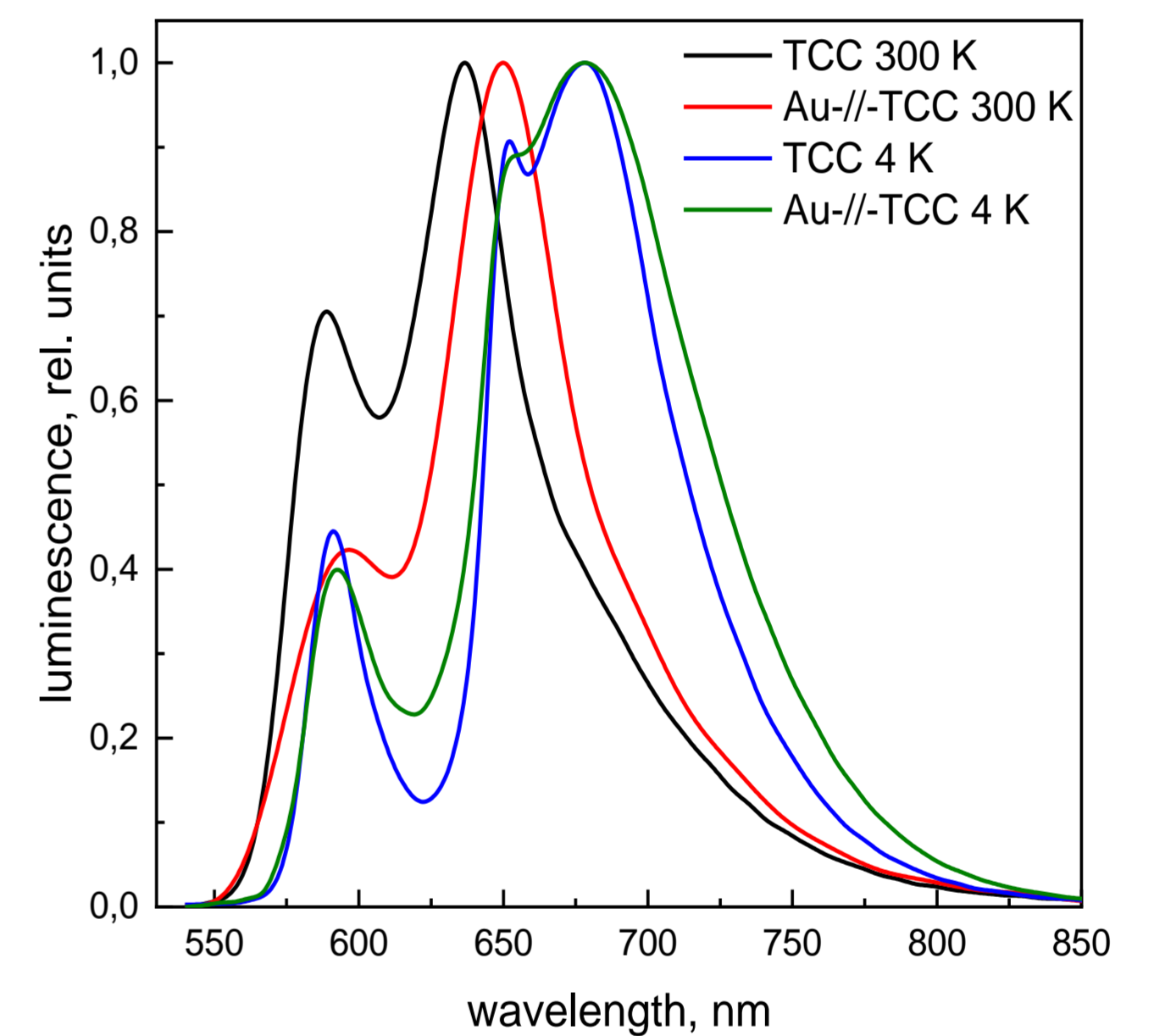
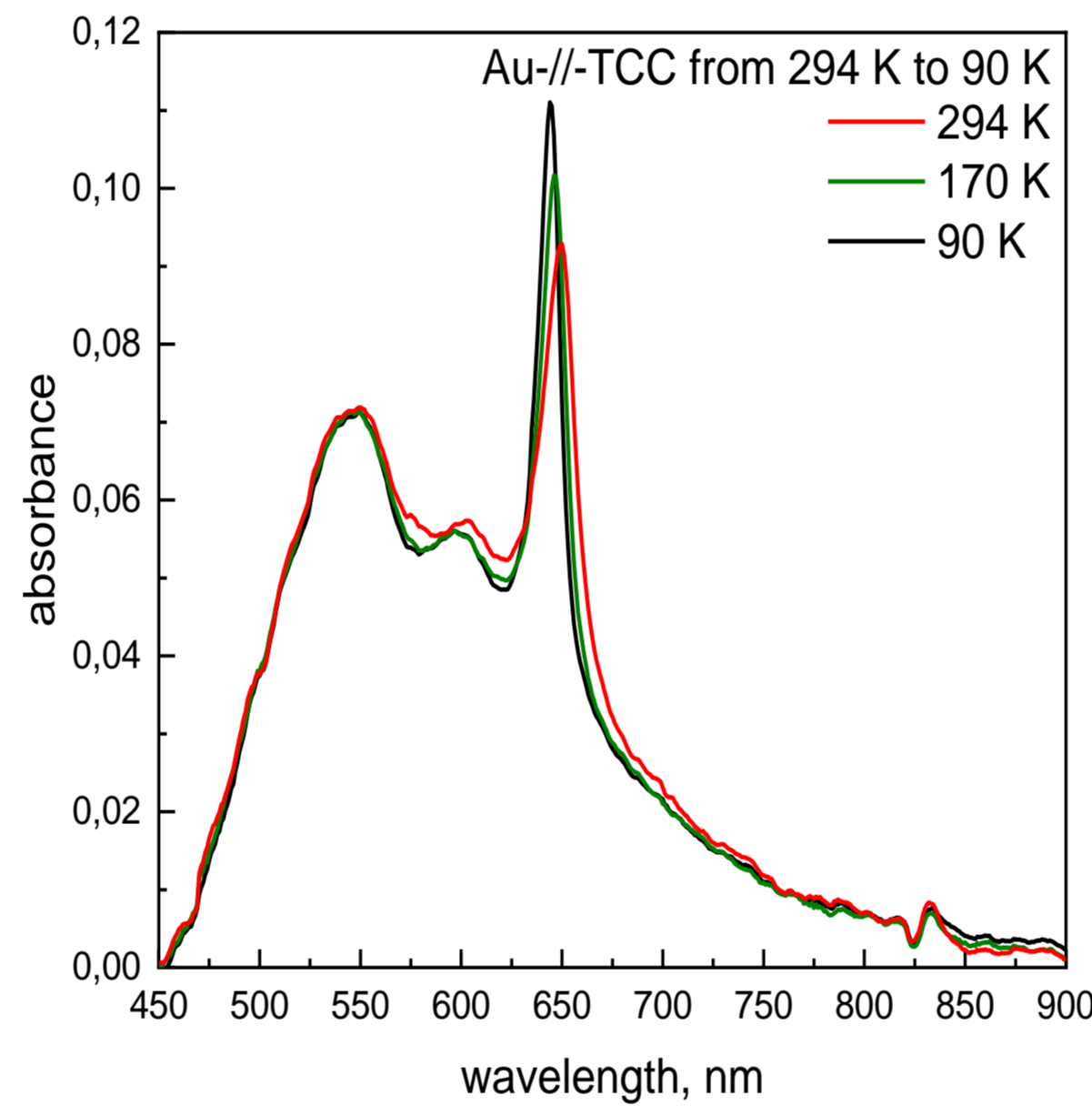
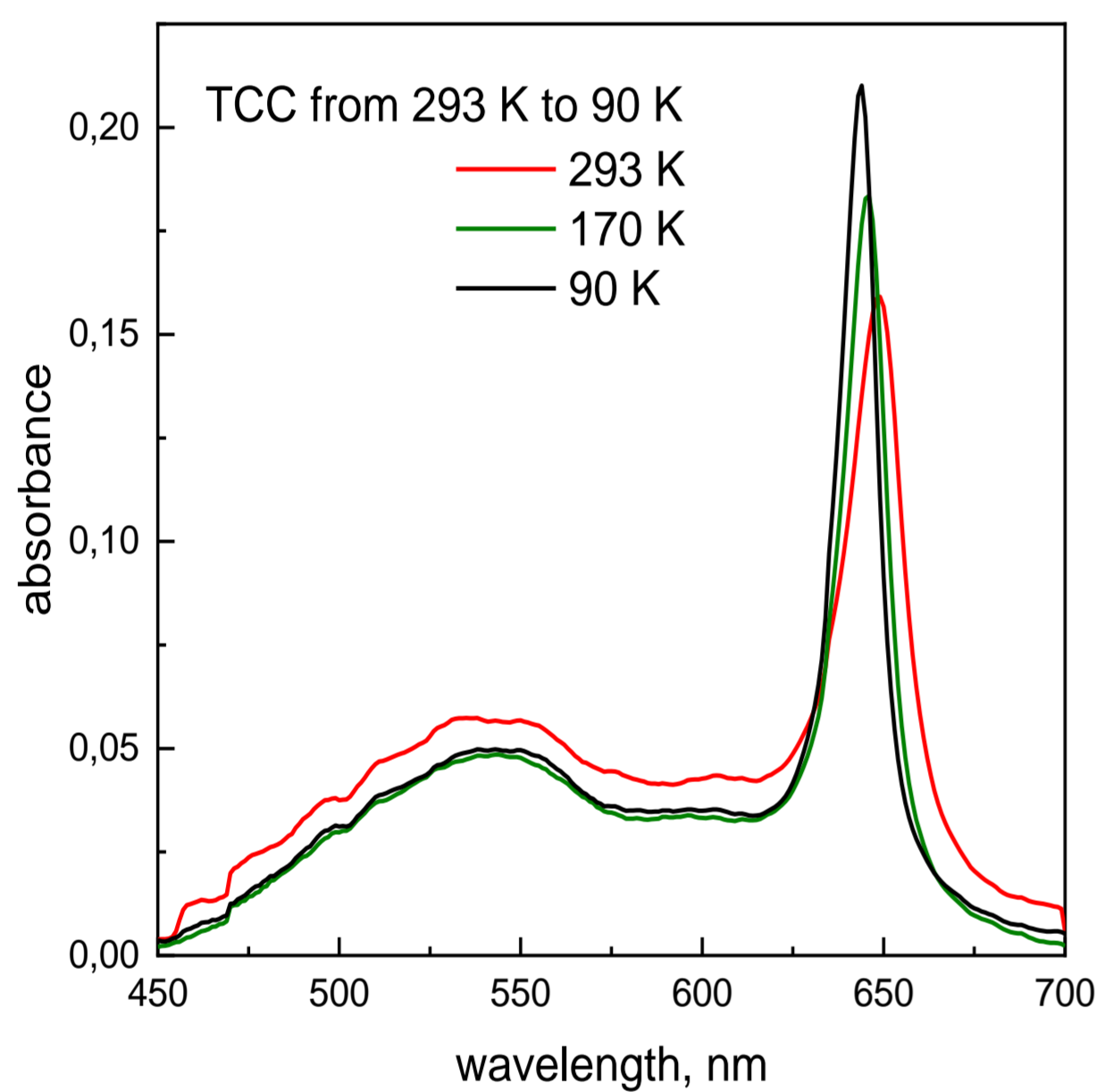
On insets – dyes structures.

## Gold nanoparticles (AuNPs)

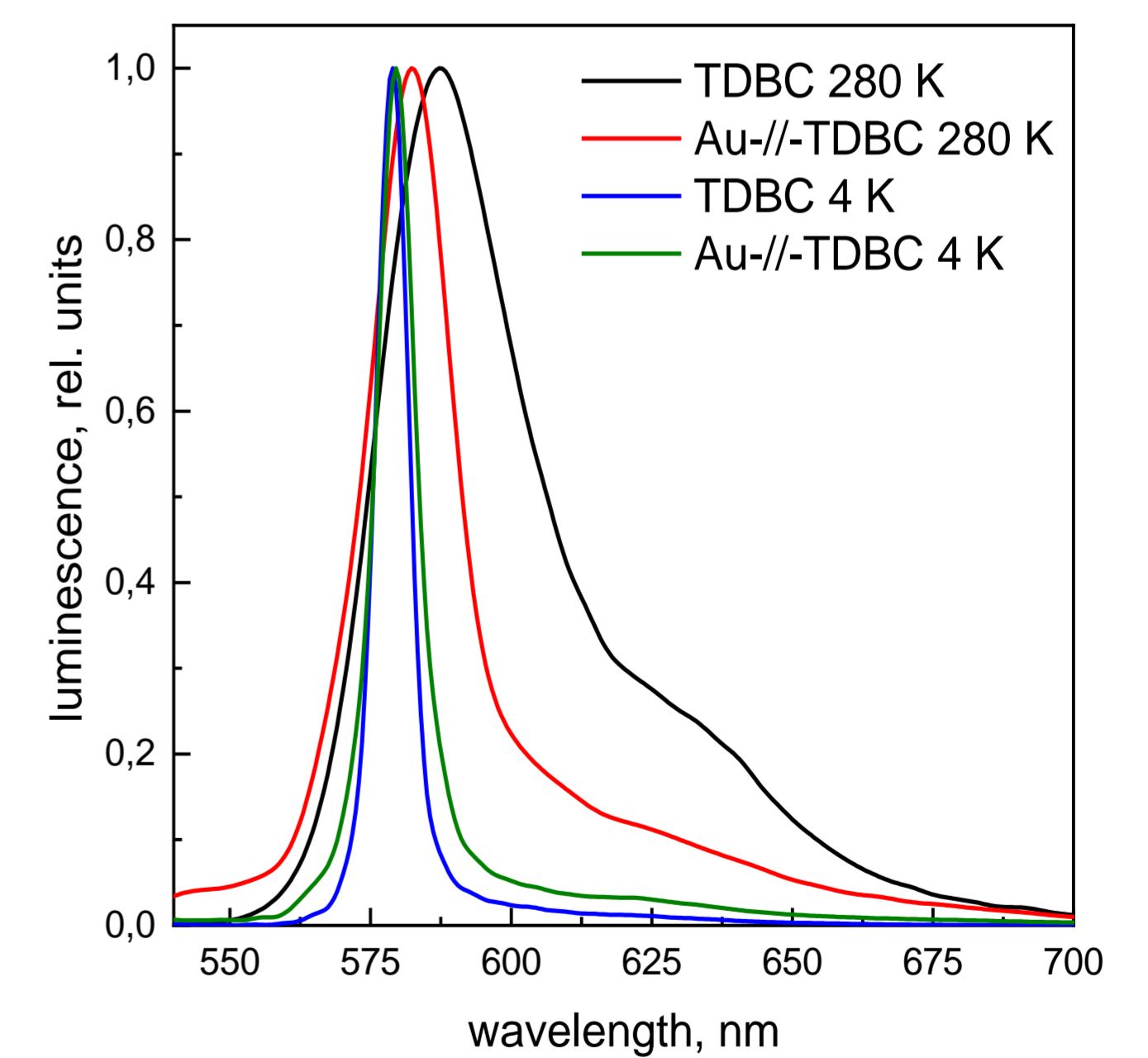
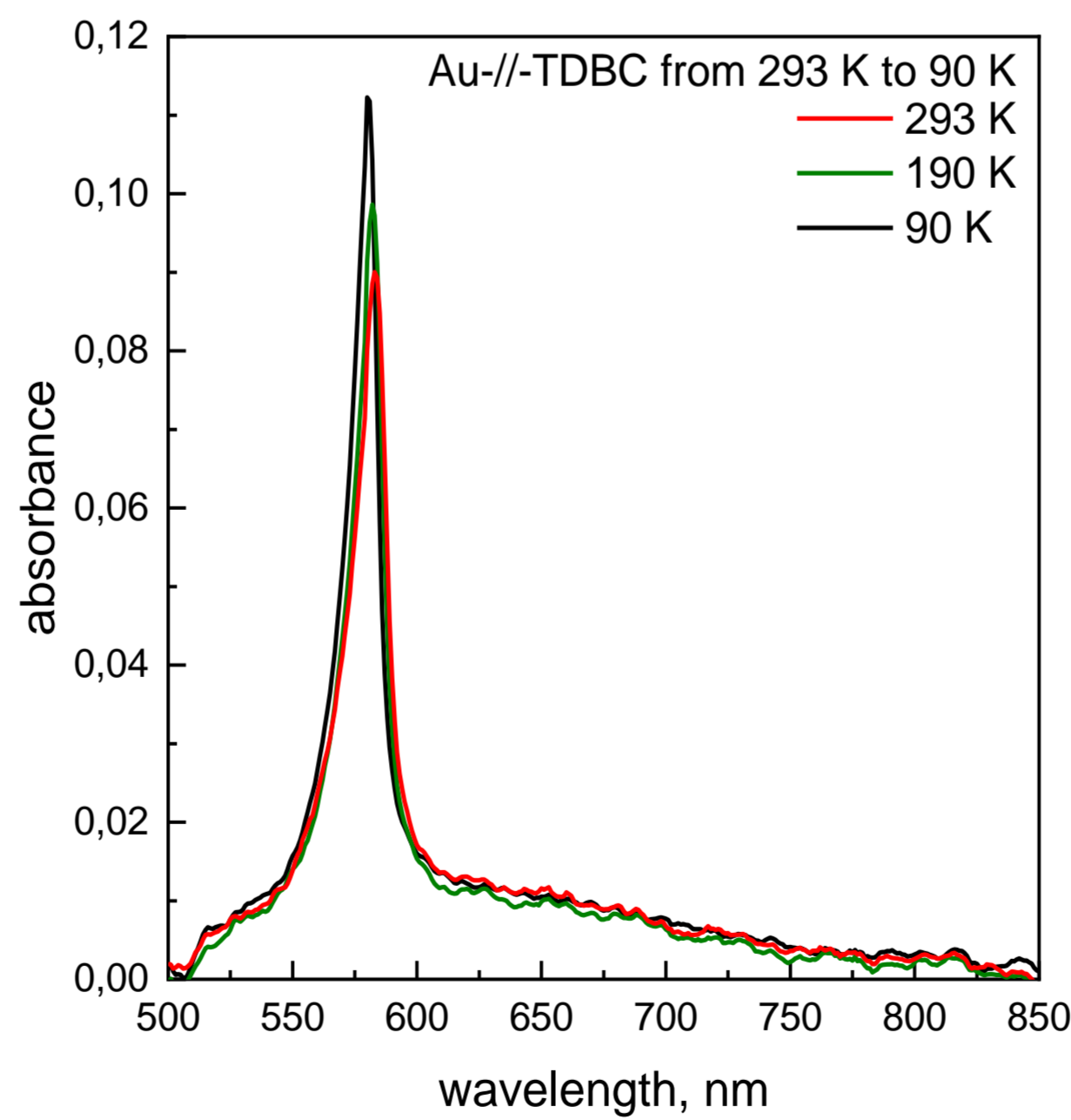
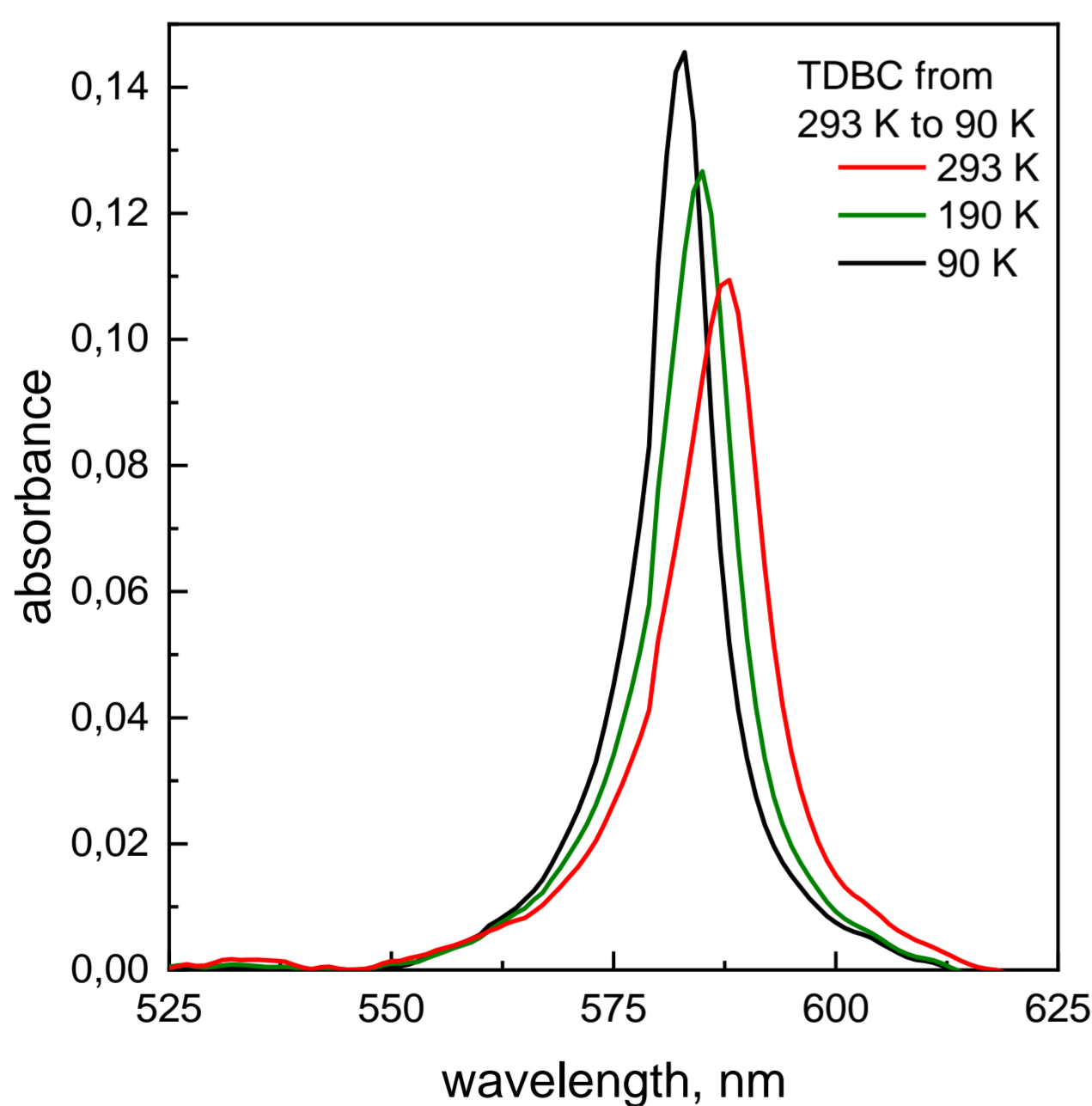


The TEM image (left) and absorption spectrum (right) of AuNPs.

## General research



Absorption (left) and luminescence (right,  $\lambda_{exc} = 530$  nm) spectra of TCC J-aggregates with and without AuNPs in a polymer film (luminescence spectra are normalized for clarity).



Absorption (left) and luminescence (right,  $\lambda_{exc} = 530$  nm) spectra of TDBC J-aggregates with and without AuNPs in a polymer film (luminescence spectra are normalized for clarity).

## Conclusions

It was demonstrated that exciton–plasmon interaction influences not only the luminescence intensity of cyanine dye J-aggregates, but also polaronic relaxation, manifested by the exciton self-trapping luminescence band clearly observed at low temperatures. Since two structurally different types of J-aggregates were investigated, the dependence of exciton–plasmon interaction on the aggregate structure, for example, on its dimensionality, can be considered. Although these results are preliminary, they clearly demonstrate the potential for further studies in this field.

