UCLA College | Physical Sciences Chemistry & Biochemistry

PHYSICAL CHEMISTRY SEMINAR

Prof. Dr. Frank Wuerthner

Organic Materials and
Nanosystems Chemistry
University of Würzburg

Monday, Oct. 12, 2020
9:00 AM
via Zoom

"Supramolecular Photosystems with Precise Spatial Organization of Dyes"

Functional materials composed of p-stacked dyes and organic semiconductor molecules have gained increasing popularity during the last two decades. However, our understanding is still rather limited with regard to the impact of particular packing arrangements in the solid state on the optical and electronic properties of dye-based materials. Studies on dye assemblies in solution[1] constitute the missing link, providing many insights into the coupling among chromophores upon p-p-stacking, in particular with regard to absorption and fluorescence properties. Within our research on dye assemblies of dipolar merocyanine dyes[2,3] and quadrupolar perylene bisimide dyes[4] we became, however, aware of severe limitations: Thus, it is very challenging for the conventional self-assembly approach to establish a particular dye-dye packing arrangement and to limit the size of an aggregate to a desired supramolecular species. Further, it is almost impossible to properly assemble different dyes into structurally defined hetero-aggregate architectures. As a consequence of these limitations many interesting scientific questions could not be addressed in the past.

In this talk I will show how foldamer [5] and macrocyclic[6,7] architectures can be utilized to position dye molecules into predefined positions. Furthermore, I will show how particular arrangements afford entirely different photophysical properties and that hetero-aggregates[8] exhibit much stronger exciton coupling as expected. Finally, also larger p-stacks with H- and J-type coupling will be investigated with regard to their usefulness for long-range exciton transport. These results should be of high relevance for the more rational design of functional organic solid state materials.

References

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