physikalisches Kolloquium

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# A Single-Molecule Approach for Reaching into the Mesoscopic Size Regime of Organic Semiconductors

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The electronic coupling and energy transfer in organic chromophore complexes, such as π-conjugated polymer assemblies or light-harvesting complexes are crucial processes. They determine the performance of organic solar cells, organic light-emitting diodes, biological and synthetic light-harvesting systems.

Unfortunately, investigating energy transfer processes in bulk measurements is almost always very difficult, because of the extraordinary morphological heterogeneity in such systems. However, single-molecule spectroscopy (SMS) is, in principle, capable of unraveling this heterogeneity, but, by definition, neglects interactions between molecules.

We can reach and investigate the mesoscopic size regime of molecules by deterministically growing multichain π-conjugated polymer aggregates[1], applying SMS-based techniques to it and comparing the aggregates with well-defined molecular model-systems.[2,3] The mesoscopic size scale is a particular interesting regime, because new properties can evolve from the same material, but non-classical features, e.g. single-photon emission and digital blinking of the fluorescence, are still present.[4,5]

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2. Aggarwal A. V., et al. Nat. Chem. 5, 964-970 (2013).
3. Stangl T., et al. J. Am. Chem. Soc. 135, 78-81 (2013).
4. Stangl T., et al. Proc. Natl. Acad. Sci. U.S.A. 112, E5560-E5566 (2015).
5. Eder T., et al. Nat. Commun. in press, (2017).