Spring School on Solar Energy and Photosynthesis
24 September 2019
Public Lecture

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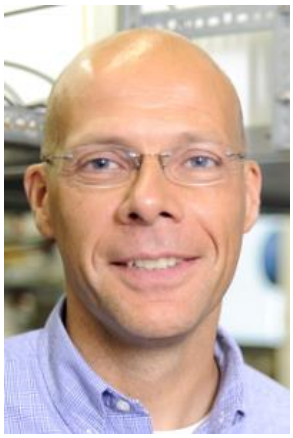

Prof. Dirk M. Guldi

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Date: Tuesday, 24 September 2019
Time: 17:30 – 19:00
Venue: Sci-Enza, University of Pretoria
Enquiries: Dr Shankara Radhakrishnan, shankara@up.ac.za

Towards breaking the barrier to 100% charge transfer

Chemistry affects almost every aspect of our existence, so that it will be an essential component of solutions in global issues in health, materials, and energy. For this reason, the design and synthesis of novel molecular materials lies at the forefront of transformative research and has game-changing character. A leading example for such shifts in existing scientific paradigms is surpassing the Shockley-Queisser limit, which places an upper bound on solar conversion efficiency for a single p-n junction solar cell at slightly more than 30%, by means of singlet fission (SF) in molecular acenes, the molecular analog to multiple exciton generation (MEG). In an optimal SF process, the lowest singlet excited state of one molecule (S_1) that is positioned next to a second molecule in its ground state (S_0) is down-converted into two triplet excited states (T_1) each residing on one of the two adjacent molecules. The two triplet states initially form a correlated pair state $^1(T_1T_1)$, which then evolves into two separated triplet states ($T_1 + T_1$). As such, the energetic requirement for SF is $E(S_1) \geq 2 \times E(T_1)$. Shifting the focus to intramolecular SF in dilute solutions rather than intermolecular SF in crystalline thin films enabled important breakthroughs.

More About Prof. Guldi:

Prof. Dirk M. Guldi completed both his undergraduate studies (1988) and PhD (1990) at the University of Cologne (Germany). Following postdoctoral appointments at the National Institute of Standards and Technology (USA), the Hahn-Meitner Institute Berlin (1992), and Syracuse University, he joined the faculty of the Notre Dame Radiation Laboratory in 1995. He was promoted a year later from assistant to associate professional specialist, and remained affiliated to Notre Dame until 2004. Since 2004, he is Full Professor in the Department of Chemistry and Pharmacy at the Friedrich-Alexander University in Erlangen. Since 2018, Dirk M. Guldi is Co-Editor in Chief of *Nanoscale* and *Nanoscale Horizons*, RSC journals focused on experimental and theoretical research in all areas of nanotechnology and nanoscience, and he has been named among the world's Highly Cited Researchers by Thomson Reuters.

The Guldi Group's research accomplishments centre on controlling photon and charge management in molecules and nanoscale materials. Impressive documentations of their accomplishments are more than 600 peer-reviewed publications, nearly 40,000 citations, and an h-index of 97. At the heart is always a multifaceted and interdisciplinary research program, where his group designs, conceptually devises, synthesizes, tests, and characterizes novel nanometre scale materials with the objective of using them in solar energy conversion schemes. A broad range of spectroscopic (i.e. time-resolved and steady-state measurements with spectrophotometric detection covering a time range from femtoseconds to minutes) and microscopic techniques (i.e. scanning probe microscopy, electron microscopy) are routinely employed to address aspects that correspond to the optimization and fine-tuning of dynamics and/or efficiencies of charge separation, charge transport, charge shift, and charge recombination processes.