Perylene-Diimide Helicenes: A New Molecular Architecture for Chiral Electronics

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Perylene-3,4,9,10-tetracarboxylic diimide (PDI) has emerged as a building block of organic materials for next generation molecular electronics. Intensely absorbing and chemically robust, PDI-based materials often excel as n-type semiconductors in organic field-effect transistors and organic photovoltaic (OPV) cells. Notably, twistacene nanoribbons arising from the iterative fusion of PDI to ethylene have been incorporated into OPV cells with power conversion efficiencies approaching 10%. However, these PDI-twistacenes interconvert rapidly between various conformations in solution, precluding the isolation of their helixes for integration into chiral electronics. In this talk, I will detail the design and preparation of the first members of a new class of persistently helical polyaromatics, the PDI-helicenes. Intramolecular π-to-π collisions in one such helicene facilitate the delocalization of electrons added to its PDI subunits. I will also show that the incorporation of multiple PDI-helicenes into a single π-helix significantly amplifies electronic circular dichroism, which can be tuned by photoreduction induced by visible light.