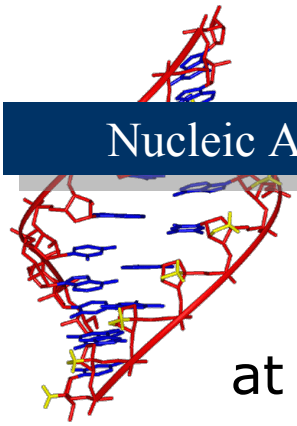

Thursday 22 June
at 11:15 in the FKF Colloquium-room

Prof. Krzysztof Walczak

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"Synthesis and properties of novel optically active molecules based on carbazole"

Abstract:

Organic electronics are one of the fastest growing technologies in the world. A history of conducting polymers begun in 1977 with discovery of the simplest, conjugated conducting polymer a polyacetylene. Polyacetylene treated with halogen vapour gave a material with conductivity of $10^5 Sm^{-1}$, 10^9 times more conductive than it was originally. Since that time several other conducting polymers has been discovered including polythiophene, polyphenylene, polypyrrole etc. The conducting polymers found application in construction of light harvesting devices (solar cells) and light emitting diodes. They successfully compete with their inorganic equivalents, challenging them in terms of the possibility of tuning their optical properties, transparency, flexibility and the production cost. The conjugated organic molecules possess additional interesting property, namely exhibit a luminescence. Luminescence is a process of light emission as a result of excitation of molecule to electronic excited states by external light and its radiative relaxation.

A versatile building block for the preparation of low molecular weight systems as well polymers is carbazole. Carbazole is a heteroaromatic easily available substrate obtained from coal-tar distillation. Its

aromaticity provides good chemical and environmental stability. Due to its aromaticity, carbazole constitutes a planar system, exhibits relatively low ionization potential and a tendency to form very unstable radical cation and itself is capable to undergo oxidation induced polymerization. Carbazole absorbs light in the range of 236-345 nm with emission maxima at 350 and 365 nm, both in violet region of spectrum. In a lecture the synthesis of series of carbazole based oligomers which exhibit strong electromagnetic absorption in the whole visible region, extending to NIR will be presented. The starting monomers exhibit a linear or star-shape architecture. Oligomers have been modified with a variety of both electron-donating and electron-withdrawing units what permitted tailoring their emissive properties. For example an incorporation of thiophene, EDOT (3,4-ethylenedioxythiophene) or other thiophene derivatives into the electron-donating systems comprising carbazole results in the bathochromic shift of the absorption and emission spectra. Addition of thiophene based linkers between 4,4-difluoro-4-bora-3a,4a-diaza-s-indacene (BODIPY) and carbazole, constituting a donor-acceptor system, also results in red shifting of the spectra. The applied synthetic procedures utilized different transformations including halogenation, alkylation, formylation reactions, Stille and Suzuki coupling reactions or condensations reactions which goal was to introduce different linkages between the heterocycles. MS study indicated that conducting polymers obtained by electrochemical oxidative polymerization comprised mostly dimers and trimers, both for donor-type star shaped systems and linear donor-acceptor ones. Higher conjugated species like hexamers, heptamers or even decamers were also formed.