The 886th IMS colloquium

The Chirality Induced Spin Selectivity (CISS) Effect- From Spintronics to Electron Transfer in Biology

Prof. Ron Naaman

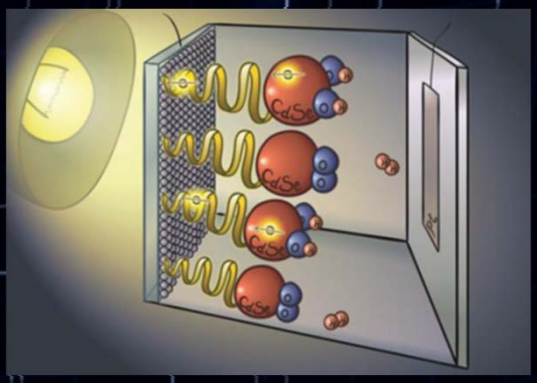
Department of Chemical Physics,
Weizmann Institute of Science, Israel
https://www.weizmann.ac.il/chemphys/naaman/

Date&Time: 2016/3/3 (Thu.) 15:00-
Place: IMS Research Building Room 201

Spin based properties, applications, and devices are commonly related to magnetic effects and to magnetic materials. Hence, most of the development in spintronics is currently based on inorganic materials. Despite the fact that the magnetoresistance effect has been observed in organic materials, until now spin selectivity of organic based spintronics devices originated from an inorganic ferromagnetic electrode and was not determined by the organic molecules themselves. Recent experiments have demonstrated that the electron transmission yield through chiral molecules depends on the electron spin orientation. This phenomenon has been termed the chiral induced spin selectivity (CISS) effect,[1] and it provides a challenge to theory and promise for organic-molecule based spintronic devices.

Different theoretical models have been used to describe the effect; however, many of them presume an unusually large spin-orbit coupling in chiral molecules for the effect to display the magnitudes seen in experiments. Recent theoretical study succeeded to overcome this difficulty and result in interesting insight on the molecular parameters controlling the effect.

I will discuss experimental results that relate to CISS based spintronics applications,[2] to the role of the effect in biological systems, specifically in Photosystem I,[3] and its importance in the production of hydrogen by water splitting.[4]



1. R. Naaman, D. H. Waldeck, *Ann. Rev. Phys. Chem.*, 66, 263–81 (2015).
2. S. P Mathew, P. C. Mondal, H. Moshe, Y. Mastai, R. Naaman, *App. Phys. Lett.*, 105, 242408 (2014).
3. I. Carmeli, K. S. Kumar, O. Hieflero, C. Carmeli, R. Naaman, *Angew. Chem.*, 53, 8953 (2014).
4. W. Mtangi, V. Kiran, C. Fontanesi, R. Naaman, *J. Phys. Chem. Lett.*, 6, 4916 (2015).

Contact: Hiroshi Yamamoto (CIMoS)
Shigeyuki Masaoka & Ryota Iino (IMS colloquium FY2015 committee)