# Spin-dependent dynamics of carriers injected across interfaces with organic semiconductors

Martin Aeschlimann

*Department of Physics and Research Center OPTIMAS, University of Kaiserslautern, 67663 Kaiserslautern, Germany*

Organic semiconductors (OSC) have considerably attracted the interest of the scientific community due to the possibility of implementing very low-cost and versatile electronic devices based on organic thin-film materials. Recently, different pioneering experiments suggested that OSC represent as well a major opportunity for application in the growing field of spintronics.

Two fundamental requirements for engineering organic spintronics devices are (i) the efficient injection of spin-polarized carriers at a hybrid inorganic-organic interface (where the inorganic material acts as source of spin polarized carriers), and (ii) a suitable spin diffusion length in the OSC themselves. Since OSC are generally characterized by moderate spin diffusion lengths but very long spin lifetimes, the most straightforward and promising route for application of OSC in spintronics is to exploit the high spin injection efficiency achievable in OSC. In this context, the ability to control and tune the spin functionality of hybrid inorganic-organic (HOI) interfaces is a central issue.

In this contribution, we will show how the spin- and time-resolved two-photon photoemission technique can be employed to quantify the spin properties of the considered HOI interface in terms of a set of microscopic parameters that fully characterize its spin functionality in the accessible energy range, the so-called pure spin-injection region [1,2]. Furthermore, we developed a microscopic interface model [3] including the following spin-dependent events for an electron crossing the interface: (i) transmission without energy loss and without spin-flip; (ii) transmission without energy loss but with a spin-flip; (iii) reflection or transmission with energy loss. Applying this model allowed us, for example, to identify the presence of a spin polarized hybrid state at the interface between a thin cobalt film and the OSC copper phthalocyanine.

[1] M. Cinchetti et al., Nature Materials **8**, 115-119 (2009).

[2] H. Ding et al., Phys. Rev. B **78**, 075311 (2008).

[3] M. Cinchetti et al., Phys. Rev. Lett., in print.