Activating the Molecular Spinterface

Prof. Dr. Mirko Cinchetti
TU Dortmund

The miniaturization trend in the semiconductor industry has led to the understanding that interfacial properties are crucial for device behaviour. Spintronics has not been alien to this trend, and phenomena such as preferential spin tunnelling, the spin-to-charge conversion due to the Rashba–Edelstein effect and the spin–momentum locking at the surface of topological insulators have arisen mainly from emergent interfacial properties, rather than the bulk of the constituent materials. In this talk I will describe inorganic/molecular interfaces by looking closely at both sides of the interface. I will discuss recent developments in the field and underline how molecular materials have arisen as an ideal platform for creating interfacial spin effects [1]. As an example, I will show that the extreme multifunctionality of organic molecules can be used to functionalize the spin properties of surfaces with a spin-texture induced by strong spin-orbit coupling. I will present our results on the following two-dimensional electronic systems: the surface states of the topological insulator Bi2Se3 [2], and the Rashba-split surface states of a Pb-Ag surface alloy [3]. Finally, I will discuss the key role that molecular interfaces may play in the development of a new generation of spin-based technologies, thanks to their unique capability of being actively tuned to reach as-yet unexplored functionalities.