Prospects in precision organic monolayer device elements at vdW interfaces

C.-A. Palma
Institute of Physics
Chinese Academy of Sciences

Synthetic molecular self-assembly stands as a versatile equivalent to programmable biomolecular nanotechnology, enabling the fabrication of complex architectures[1]. So far, the self-assembly of synthetic architectures has not enjoyed the predictability of its biomolecular counterpart[2], yet possesses untapped potential for the fabrication of precision organic devices[3] - where the active synthetic elements are precisely ordered down to the atomic level. Atomically flat van der Waals (vdW) interfaces offer a simplified paradigm towards prospective precision molecular devices, by seamlessly templating extended molecular monolayers and/or serving as inert electrode interfaces. In this talk, I will present first attempts to computationally-design metal-organic frameworks[4] and monolayer charge transport systems on boron nitride. I will continue with proof-of-principle optoelectronic response measurements of supramolecular architectures on graphene on diamond interfaces[5], prospects for their bottom-up three-dimensional growth, and new paradigms for the on-surface coupling of polyaromatic systems on boron nitride[6] and diamond.

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Carlos-Andres Palma is associate professor of physics at the Institute of Physics, Chinese Academy of Sciences. Prior to joining the Institute of Physics, he worked at the TU Munich, the Max-Planck Institute for Polymer Research, ETH Zurich, University College London and the University of Strasbourg, where he completed his MSc and PhD in 2010. His research focuses on big data atomistic modeling, ultrahigh vacuum instrumentation and device physics for precision molecular technology. His current interests involve organic monolayer-by-monolayer growth, monolayer photoresists and organic quantum topology.