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Electronic Transport Across Chiral Molecules

Latha Venkataraman

[a]*Am Campus 1, 3400 Klosterneuburg, Austria. Email: latha.venkataraman@ist.ac.at*

Abstract:

Over the past decade, there has been tremendous progress in the measurement, modeling and understanding of structure-function relationships in single molecule circuits. Experimental techniques for reliable and reproducible single molecule junction measurements have led, in part, to this progress. In particular, the scanning tunneling microscope-based break-junction technique has enabled rapid, sequential measurement of large numbers of nanoscale junctions allowing a statistical analysis to readily distinguish reproducible characteristics. Although the break-junction technique is mostly used to measure electronic properties of single-molecule circuits, in this talk, I will demonstrate its use to measure conductance and current-voltage characteristics of chiral molecules using a magnetized scanning tunneling microscope substrate and a standard gold tip. I will present results of our measurements over a series of molecules that include both conjugated and saturated systems. These results show no dependence on external magnetic field or chirality in both conductance and current-voltage measurements. I will also present results from ab initio Hartree-Fork calculations combined with the non-equilibrium Green's function method that reveal that the spin-orbit coupling within chiral junctions bound to a few gold atoms is generally too weak to induce detectable spin polarizations from spin flipping or spin filtering during the ultrafast electron-transport timescale.