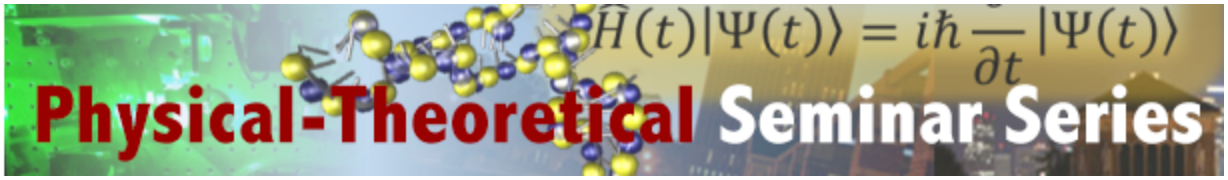

Monday, April 16, 2018, 12:00 pm
Seaver Science Library, Room 150
SSC Auditorium next to the library

Professor Latha Venkataraman

Department of Applied Physics and Chemistry
Columbia University

Quantum Interference Based Single-molecule Insulators

Molecular-scale insulating and dielectric materials rely on the exponential attenuation of tunneling with increasing length, presenting a potential problem of increased leakage current as the dimensions of the device decrease. An alternative design strategy is to use molecules with destructive quantum interference in the electronic transmission. However, a small molecule where all tunneling paths are fully cancelled has not been realized because contributions to the tunneling transmission from both the sigma and pi-orbital systems must be suppressed. Here, we report the first saturated molecule with destructive sigma-interference and realize the first quantum interference based single-molecule insulator utilizing a functionalized bicyclo[2.2.2]octasilane moiety. We demonstrate through a combination of conductance measurements and ab-initio calculations that the functional moiety in this sub-nanometer fully saturated molecule is a better insulator than the vacuum it occupies. We also show that it has a record thermopower (0.97 mV/K), providing an experimental signature of destructive interference where all tunneling paths are significantly suppressed. This molecular design thus provides a proof-of-concept for the quantum interference based approach to single-molecule insulators and sets a new standard for short insulating molecules.

Supplemental reading:

Li, H.; Garner, M. H.; Su, T. A.; Jensen, A.; Inkpen, M. S.; Steigerwald, M. L.; Venkataraman, L.; Solomon, G. C.; Nuckolls, C. *Journal of the American Chemical Society***2017**, *139*(30), 10212–10215.

Su, T. A.; Neupane, M.; Steigerwald, M. L.; Venkataraman, L.; Nuckolls, C. *Nature Reviews Materials***2016**, *1*(3), 16002.

Hosted by Professor Anna Krylov

The scientific community is invited

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