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ICTS MONTHLY COLLOQUIUM

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 organic 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 simultaneously suppressed. Here, I will report on a fully saturated molecule, a functionalized bicyclo[2.2.2]-octasilane moiety, where destructive sigma-interference decreases its conductance dramatically to create an effective single-molecule insulator. I will 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. I will 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.

Latha Venkataraman

Latha Venkataraman received her Bachelor's degree in Physics from Massachusetts Institute of Technology in 1993 and her PhD in Physics from Harvard University in 1999 working under the guidance of Prof. Charles Lieber. She worked as a research scientist at Vytran Corporation from 1999 to 2002. In 2003, she joined Columbia University as a research scientist. She started her independent career as an assistant professor in the Department of Applied Physics at Columbia University in 2007. She is currently Lawrence Gussman Professor of Applied Physics and holds a joint appointment with the Department of Chemistry.

3.30 pm, 16 Dec 2019
Madhava Hall
ICTS Bengaluru