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Guiding electrons in carbon nanostructures using topological defects

VINCENT MEUNIER, Oak Ridge National Laboratory

The paradox of perfection (i.e. flaws make things perfect) could be the key to designing nanoelectronic circuits from carbon nanostructures, such as nanotubes or graphitic nanoribbons. While individual carbon nanotubes can be exceptionally good conductors, connecting nanotubes into usable circuits is not easy, and in fact the networks realized from the connections between individual nanotubes do not conduct well. In this talk, I will present an overview of the studies we performed to determine the effect of topological defects on the electronic transport in complex carbon nanostructres. The theoretical findings will be compared to experimental data when available. First, I will present evidence that the transparency of nanojunctions can be improved dramatically by adding defects to the connecting ends of the nanonetworks. Second, I will show how these defects can be important for electrochemical energy storage applications. Finally, I will indicate how these findings can be used to devise practical devices with tailored properties.