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Magneto-Resistance of Nanoscale Molecular Devices[1]

ERAN RABANI, Tel Aviv University

Affecting the current through a molecular or a nano-scale junction is usually done by a combination of bias and gate voltages. Magnetic fields are less studied because nano-devices can capture only low values of the magnetic flux. Here, I review our recent theoretical work on the use of magnetic fields as gates for such junctions. Several plausible model systems of such devices will be presented, such as the quantum corral, carbon nanotubes and polycyclic aromatic hydrocarbon molecules. Despite the similarly between gating properties of the magnetic and electric fields, we find that there are also striking differences. This will be illustrated for a multi-terminal device, where the polarity of the magnetic field plays a key role, and with respect to inelastic effects, where the conductance as a function of the gate voltage broadens upon coupling to phonons while it actually narrows considerably in response to a magnetic field.

[1]In collaboration with Oded Hod, Rice University and Roi Baer, The Hebrew University.