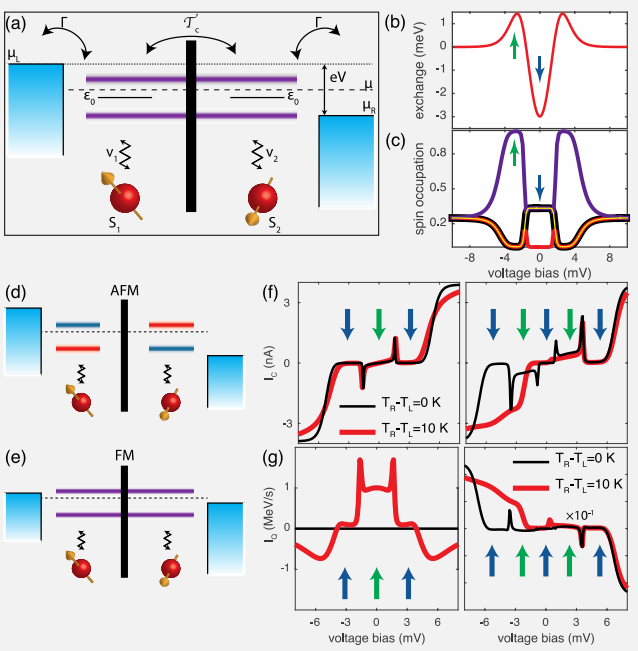
ITU Energy Institute Seminar

Date**: 8 March 2018**
Time: **10:00**
Venue: Nejat Aybers Seminar Hall, Energy Institute, Istanbul Technical University, Maslak, Istanbul, Turkey

The relation between electric current and magnetic interactions in molecular junctions

Abstract

Utilizing the possibility to electrically and thermally control the magnetic exchange, Figs. 1 (b) – (e), interactions between localized magnetic moments [1,2], we here present results regarding the charge and heat transport properties in dimer comprising, for example, paramagnetic molecules, see Fig. 1 (a) for schematics. We consider both charge, Fig. 1 (f), and heat, Fig. 1 (g), transport under non-equilibrium conditions imposed using voltage bias and temperature difference across the junction [3]. Generic properties for both transport quantities are reduced currents in the magnetically active regime compared to the inactive, or, paramagnetic, and efficient current blockade in the anti-ferromagnetic regime. In contrast, while the charge current is about an order of magnitude larger in the ferromagnetic regime, compared to the anti-ferromagnetic, the heat current is efficiently blockaded there as well [3]. This disparate behavior of the heat current is attributed to current resonances in the ferromagnetic regime which counteract the normal heat flow. It can also be noted that the temperature difference has a strongly reducing effect of the exchange interaction, which tends to destroy the magnetic control of the transport properties. The upside of the weakened exchange interaction is a possibility to tune the system into thermal rectification, for both the charge and heat currents.



[1] J. Fransson, J. Ren, and J. -X. Zhu, Phys. Rev. Lett. **113**, 257201 (2014).

[2] T. Saygun, J. Bylin, H. Hammar, and J. Fransson, Nano Lett. **16**, 2824 (2016).

[3] J. D. Vasquez Jaramillo and J. Fransson, J. Phys. Chem. C, **121**, 27357 (2017).

Speaker

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Research Interests

Non-equilibrium condensed matter physics with special attention to the modeling of nanostructures systems and local probing techniques. Particular focus is directed on impurity scattering in two-dimensional systems, where the impurities possess bosonic (vibrational, spin, ...) degrees of freedom which give rise to inelastic scattering processes. Interactions between local defects adsorbed onto surface of modern materials e.g. superconductors, graphene, topological insulators, and strongly spin-orbit coupled surfaces.