Beyond Charge Transport in Nanostructures: Spin Exchange NEGF

Challenge/Objective:

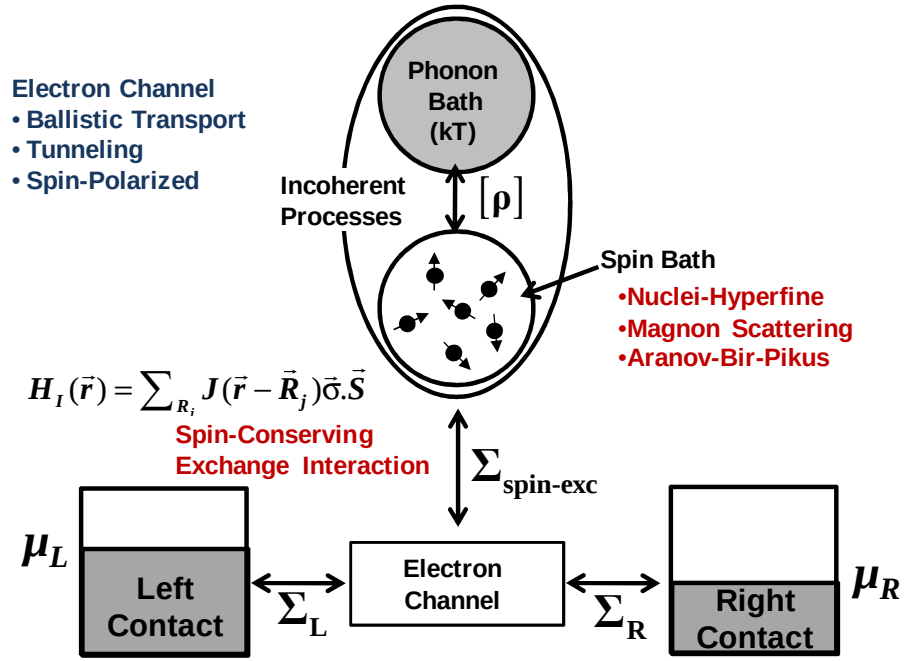
- Our understanding of non-equilibrium transport processes involving multiple elementary excitations in real solids is extremely limited.
- Develop an advanced quantum transport model integrating spin exchange interactions
- Explain complex behavior of multiple interacting spin channels/baths driven out of equilibrium

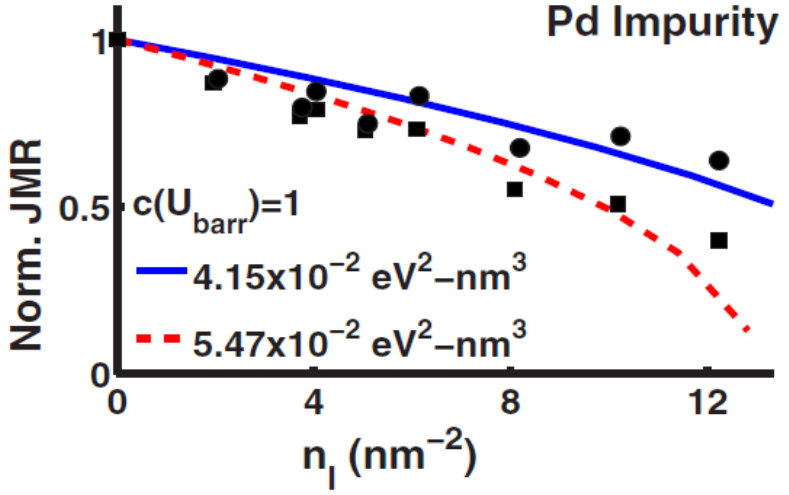
Approach:

- Use self energies to incorporate spin-conserving spin-flip interactions among different channels
- Use density matrices for the localized spin bath due to the incoherent thermalization processes

Impact:

- Explained experimental observations on quantum tunneling processes of spin polarized electrons through localized magnetic impurities
- Further studies include electron-nuclei interactions in the quantum hall regime





Yanik et al, PRB (2007)

PURDUE UNIVERSITY *Ahmet Ali Yanik*