Manipulation of nuclear spins in semiconductor nanostructures
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Abstract
A single electron spin localized in III-V semiconductor structure is an attractive candidate for a solid state quantum bit. An outstanding bottleneck towards spin-based quantum computation has been the fast dephasing of the electron spin by the inevitable nuclear spin environment. In this talk, I will discuss preparations of nuclear spin environment using optical and electrical controlled dynamic nuclear spin polarization to substantially increase the electron spin dephasing time. I will also introduce a novel approach to squeeze the nuclear spin bath into many-body singlets, where the deleterious environmental moments are effectively annihilated. The large scale entanglement in many-body singlets may also become a useful resource for nuclear spin based information processing.