Condensed Matter Theory Center Seminar

Friday, June 2
11:00 am – 12:15 pm
2205 John S. Toll Physics Building

Xin (Sunny) Wang
City University of Hong Kong

"On the advantage of barrier over tilt control of a singlet-triplet spin qubit"

Abstract: Overcoming the charge noise is key to the realization of scalable quantum computation using spin qubits. It has been recently demonstrated that the effects of charge noise can be suppressed if operations of a singlet-triplet qubit are implemented using barrier control instead of the traditional tilt control. We have found, however, that for certain gates involving extensive x-rotations, barrier control offers little or no improvement when the nuclear noise is significant. Nevertheless, we introduce a new set of composite pulses that reduce gate times by up to 90%. Using these optimized pulses, the barrier control shows great advantages in randomized benchmarking simulations, with the coherence time extended by about two orders of magnitude for experimentally relevant noises [1]. We have also performed a microscopic calculation of a singlet-triplet qubit under the influence of an impurity. We have found that, the relative charge noise (charge noise divided by the exchange interaction), while generally believed to increase with increasing exchange interaction, actually decreases when the barrier control is implemented [2]. This is understood as a combined consequence of the greatly suppressed detuning noise when the two dots are symmetrically operated, as well as an enhancement of the inter-dot hopping energy of an electron when the barrier is lowered.

References

[1] C. Zhang, R.E. Throckmorton, X.-C. Yang, X. Wang, E. Barnes, S. Das Sarma, arXiv:1701.03796 (Phys. Rev. Lett. in press)

[2] X.-C. Yang, X. Wang, arXiv:1704.07975

Host: Robert Throckmorton

Web: http://www.physics.umd.edu/cmtc/seminars.html