KIDS TALK

“High-fidelity geometric quantum gates on individual solid-state spins in diamond”

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Abstract: A quantum computer would be able to solve important problems that are intractable for a classical computer. On the way to the realization of a quantum computer experimental imperfections and decoherence are the major hurdles. Quantum error correction codes enable the construction of quantum computers from a universal set of realistic, imperfect quantum gates. However, quantum error correction codes only become efficacious, if the fundamental quantum gate reaches a certain fidelity. Depending on the correction code this error threshold per gate lies between 10^{-6} to 10^{-2}. On the search for realistic quantum computing architectures, therefore, one needs to rely on fault-tolerant hardware. To this end, quantum gates based on geometric instead of dynamic phase shifts may provide intrinsic fault-tolerance, as geometrical phases show remarkable robustness with respect to certain types of experimental errors.
Here we show an experimental realization of an all-geometric single-qubit quantum gate on a single spin at room temperature. This quantum gate is based on a recent proposal for holonomic quantum computing featuring both fast (non-adiabatic) and universal (non-Abelian) quantum gate performance. In resorting to a single nitrogen-vacancy color center in diamond we achieve close to perfect quantum gate fidelities exceeding 0.98. This quantum gate realization is based on integrable and scalable hardware exhibiting strong analogy to current silicon technology and it is a promising step towards viable, fault-tolerant quantum computing under ambient conditions.

When: Friday, February 13th, 10:00 am

Where: Room 46-387/388

All undergraduate and graduate students as well as postdocs are welcome and encouraged to join our discussion!

********* **COFFEE**, **TEA** AND **COOKIES** WILL BE SERVED *********

For subscription to kids mailinglist, questions, comments or suggestions:
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