Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Decoherence Free Neutron Interferometer[1] DMITRY PUSHIN, MIT, MICHAEL HUBER, MUHAMMAD ARIF, NIST, DAVID CORY, MIT, PI — A neutron interferometer (NI) is a unique example of the macroscopic quantum coherence and has been used to test fundamental principles of quantum mechanics. In practice, neutron interferometers are not widely used because of their extreme sensitivity to environmental noise which is in part due to the slow velocity (relative to light) of the neutron. We show that a neutron interferometer design can benefit from concepts of quantum information processing. We have machined a Decoherence Free (DF) neutron interferometer that was designed based on a quantum error correction code and is much less sensitive to mechanical vibrations than is the standard Mach-Zehnder (MZ) interferometer. We demonstrate improvements of the DF design with a five blade single crystal NI that incorporates both the MZ and DF geometries in one crystal. We have found that the DF interferometer is much less sensitive to vibrations. We believe that our results and related quantum information approaches will enable a new series of compact neutron interferometers that can be tailored to specific applications in soft condensed matter and spintronics.

[1]This work was supported in part by the National Security Agency (NSA) under Army Research Office (ARO) contract number W911NF-05-1-0469. Support provided NIST is gratefully acknowledged.

Dmitry Pushin
MIT

Date submitted: 20 Nov 2009 Electronic form version 1.4