DNP08-2008-000338

Abstract for an Invited Paper
for the DNP08 Meeting of
the American Physical Society

Precision Neutron Scattering Length Measurements Using Neutron Interferometry[1]

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The neutron interferometer, pioneered by Werner and Rauch in the 1970's, splits the neutron matter wave into two paths by Bragg diffraction in a perfect silicon crystal, then recombines them coherently to produce a interference signal measured by a neutron counter, thereby directly obtaining an interaction amplitude via the phase shift. It has been used to make famous demonstrations of quantum phenomena that are now found in many textbooks. It is also an ideal instrument for precision measurement of low-energy neutron scattering lengths that are important for developing and testing nuclear potential models and effective field theories, and probing neutron substructure. I will describe previous experiments and the current program at the NIST Neutron Interferometry and Optics Facility.

[1]Work sponsored by NSF grant PHY-0555347 and NIST (U.S. Dept. of Commerce).