The NIST/NSF Center for High Resolution Neutron Scattering

NSF DMR-1508249

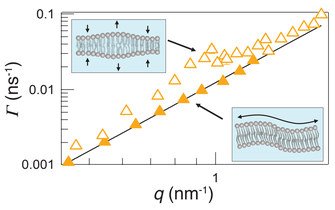
NIST Center for Neutron Research
Gaithersburg, MD 20899

Dan Neumann, Director
Julie Borchers, Associate Director

CHRNS Center for High Resolution Neutron Scattering — NIST

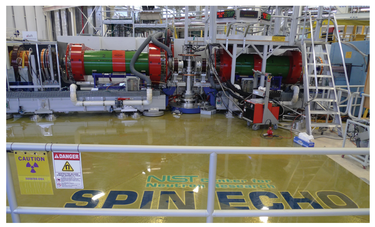
A partnership between the National Science Foundation and NIST to develop and operate neutron scattering instrumentation for use by the scientific community

The influence of tail length mismatch on the structure and dynamics of fluid lipid membranes



Hydrophobic mismatch between lipids is expected to play an important role in determining the local membrane structure as well as the collective membrane dynamics. NSE experiments reveal that mixed lipid bilayers are more dynamic than their single component analogs, highlighting the importance of lipid composition in determining the membrane biophysical properties.

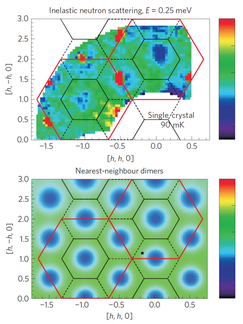
Neutron Spin Echo Instrument at NG-A



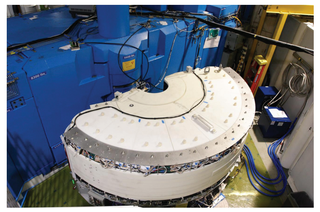
E. G. Kelley, R. Ashkar, R. Bradbury, P. D. Butler, M. Nagao, submitted to J. Am. Chem. Soc. (2016).

Physical realization of a quantum spin liquid based on a complex frustration mechanism

In a quantum spin state, magnetic moments remain in collective motion down to the lowest temperatures. Experimental realizations of quantum spin systems remain very few. Current experiments on $Ca_{10}Cr_7O_{28}$ show all the signatures expected of a quantum spin liquid, with persistent slow dynamics in the ground state and spinon excitations. This long-sought state arises from a completely new and unexpected frustration mechanism due to a complex Hamiltonian consisting of several different isotropic interactions, including strong ferromagnetic and weaker antiferromagnetic couplings.

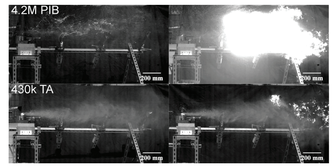


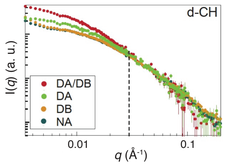
Multi-Angle Crystal Spectrometer at BT-9



C. Balz, *et al.*, Nature Physics **12**, 942 (2016).

Megasupramolecules for safer, cleaner fuel by end association of long telechelic polymers



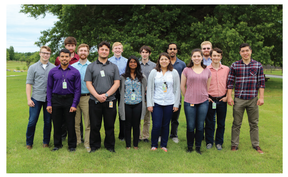


Polymers have been designed that defy conventional wisdom by self-assembling into "megasupramolecules" (≥5000 kg/mol) at low concentration. Viscometry and scattering measurements of long telechelic polymers having polycyclooctadiene backbones and acid or amine end groups verify the formation of megasupramolecules. These molecules control misting and reduce drag in the same manner as ultralong covalent polymers, but with short building blocks and reversible linkages, these megasupramolecules overcome the obstacles of shear degradation and engine incompatibility.

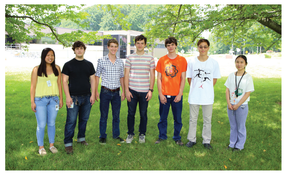
SANS Instrument at NG-B

M. H. Wei, B. Li, R. L. A. David, S. C. Jones, V. Sarohia, J. A. Schmitigal, J. A. Kornfield, Science, **350**, 72 (2015).

Education and Outreach



Summer Undergraduate Research Fellowship Program (SURF)



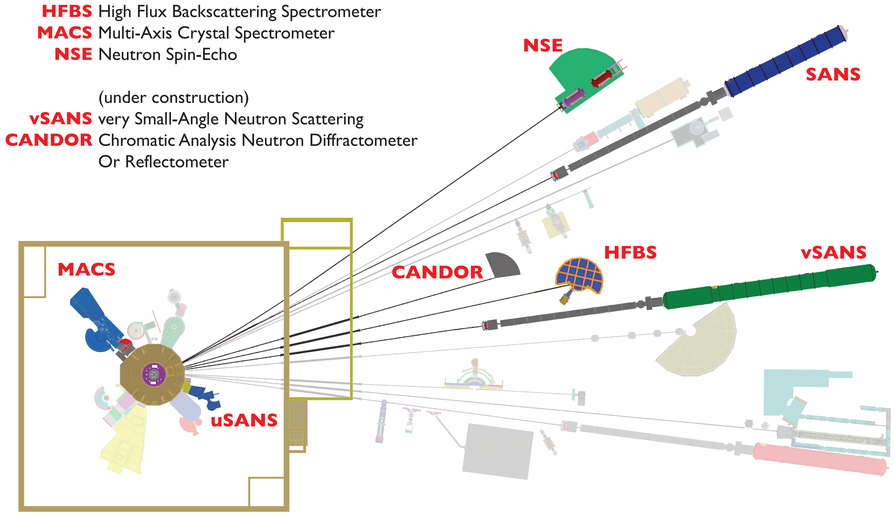
Summer High School Internship Program (SHIP)

2016 CHRNS Summer School "Fundamentals of Neutron Scattering"

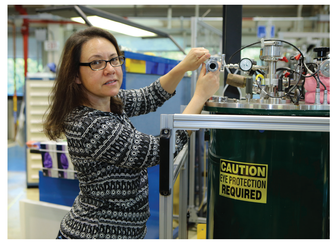
CHRNS Instrumentation

SANS 30-meter Small-Angle Neutron Scattering
uSANS ultra Small-Angle Neutron Scattering
HFBS High Flux Backscattering Spectrometer
MACS Multi-Axis Crystal Spectrometer
NSE Neutron Spin-Echo

(under construction)
vSANS very Small-Angle Neutron Scattering
CANDOR Chromatic Analysis Neutron Diffractometer Or Reflectometer



Supporting Capabilities



A wide range of state-of-the-art **sample environment equipment**, well- equipped and supplied **laboratories**, and technical **expertise** are available to CHRNS users.

^{3}He spin filters with record-setting polarizations and lifetimes approaching the theoretical limit are available for experiments on SANS and MACS that require polarized neutrons.