OPPORTUNITIES AND TECHNIQUES IN THE NHMFL HIGH B/T FACILITY AT THE UNIVERSITY OF FLORIDA

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The scientific opportunities for research at ultra-low temperatures in high magnetic fields at the National High Magnetic Field Laboratory (NHMFL) High B/T Facility [1] at the University of Florida [2] are overviewed. The facility includes two nuclear demagnetization refrigerators for studies below 1 mK and up to 16.5 T. In addition, a fast turn-around dilution refrigerator is available for testing samples down to 10 mK and up to 10 T. One of the nuclear demagnetization stages employs a $PrNi_5$ refrigerant and has a cooling power of 10 nW down to 0.4 mK, Fig. 1. The second nuclear refrigerator uses Cu for the demagnetization material and can cool samples down to 0.1 mK. The facility employs electro-magnetic shielding and active vibration isolation to provide an ultra-quiet environment that is often critical for high sensitivity measurements at sub-milliKelvin temperatures.

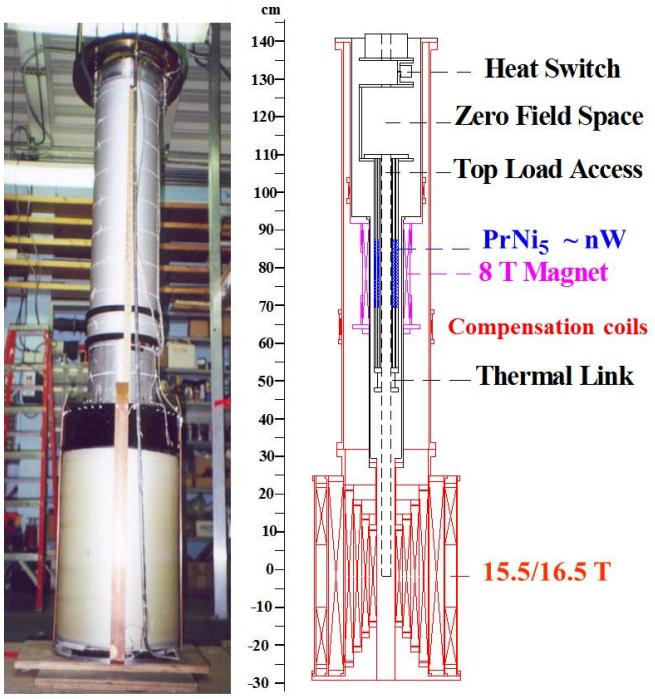

Figure 1. A photograph and a schematic drawing of the integral magnet system in Bay 3 of the NHMFL High B/T Facility.

Instrumentation is available for a wide variety of studies including ac magnetic and dielectric measurements, transport studies, nuclear magnetic resonance and nuclear quadrupole experiments, and ultrasound measurements. Some recent experiments include exploration of the Bose glass state in organic quantum magnets [3], properties of exotic quantum Hall states [4], dynamics and quantum plasticity in solid helium [5], and topological insulators.

The NHMFL High B/T Facility is supported by NSF Grant DMR-1157490 and by the State of Florida.

[1] https://nationalmaglab.org/user-facilities/high-b-t-facility
[2] http://www.phys.ufl.edu/microkelvin/index.html
[3] R. Yu, L. Yin, N.S. Sullivan, J.S. Xia, C. Huan, A. Paduan-Filho, N.F. Oliveira Jr, S. Haas, A. Steppke, C.F. Miclea, F. Weickert, R. Movshovich, E.-D Mun, B.L. Scott, V.S. Zapf, T. Roscilde, Nature 489, 379–384 (2012).
[4] W. Pan, A. Serafin, J.S. Xia, L. Yin, N.S. Sullivan, K.W. Baldwin, K.W. West, L.N. Pfeiffer, D.C. Tsui, Phys. Rev. B 89, 241302(R) (2014).
[5] D. Candela, C. Huan, S.S. Kim, L. Yin, J.S. Xia, N.S. Sullivan, J Phys.: Conf. Ser. 568, 012017 (2014).