

MAR15-2015-020875

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Extending cryogen-free experimental platforms into the microkelvin regime

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The advent of high performance cryogen-free dilution refrigerators has had a significant impact on the availability of turn-key experimental platforms in the mK temperature regime, coupled to advantages in available experimental space and flexibility of measurement systems. A strategic objective of the European Microkelvin Platform www.emplatform.eu has been to extend available temperatures into the microkelvin regime. In collaboration with Oxford Instruments Nanoscience we have constructed a first prototype system [1], which achieved a temperature of 600 μ K, with an estimated residual heat leak of 5 nW. Temperatures were measured by SQUID-based current sensing noise thermometry. We anticipate a fully engineered system will have significantly enhanced performance. [1] A microkelvin cryogen-free experimental platform with integrated noise thermometry, G. Batey, A. Casey, M.N. Cuthbert, A.J. Matthews, J. Saunders, A. Shibahara, *New Journal of Physics* 15, 113034 (2013). [2] Current Sensing Noise Thermometry: A fast practical solution to low temperature measurement, Andrew Casey, Frank Arnold, Lev V. Levitin, Chris P. Lusher, John Saunders, Aya Shibahara, Harriet van der Vliet, Dietmar Drung, Thomas Schurig, Graham Batey, Michael Cuthbert, Anthony Matthews. *J. Low Temp. Phys.* 175, 764-775 (2014).