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Unusual behavior of uranium dioxide at high magnetic fields. Part II*. M. JAIME, LANL, K. GOFRYK, INL, V. ZAPF, N. HARRISON, LANL, A. SAUL, Aix-Marseille Univ., G. RADTKE, Univ. Paris, J.C. LASHLEY, LANL, M. SALAMON, UT Dallas, A.D. ANDERSSON, C. STANEK, T. DURAKIEWICZ, J.L. SMITH, LANL — More than 65 years worth of unrelenting experimental and theoretical research on seemingly uncomplicated UO_2, a Mott-Hubbard insulator with well-localized $5f-$electrons and a fluorite *fcc* crystal structure, have not been able to elucidate some important questions such as the detailed nature of the low temperature AFM state, or the reasons behind unusual lattice properties that severely hinder the ability of this important nuclear material to transport heat. The high thermal conductivity shown by its non-magnetic counterpart, ThO_2, has hinted to the notion that unusual spin-lattice coupling is behind the crippled thermal behavior of UO_2. Here we present results of our thermodynamic investigations, on well-characterized and oriented single crystals, focusing on fiber Bragg grating magnetostriction measurements in pulsed magnetic fields to 90T at the NHMFL PFF. Our data support a multidomain non-collinear 3-**k** AFM order below 30.8K, coupled to an oxygen-cage trigonal distortion that breaks time reversal symmetry. *Work supported by the US DOE BES, Mat. Sci., and Eng. Div. The NHMFL PFF is supported by the NSF, the U.S. DOE., and the State of Florida through NSF coop. grant DMR-1157490. Work at LANL was supported by the U.S. DOE BES project "Science at 100 Tesla".

Marcelo Jaime
LANL

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