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Ultra-slow Magnetic Order-Order Transition in the Spin Chain Antiferromagnet Ca3Co2O6 O.A. PETRENKO, University of Warwick, Department of Physics, Coventry, CV4 7AL UK, S. AGRESTINI, C.L. FLECK, L.C. CHAPON, C. MAZZOLI, A. BOMBARDI, M.R. LEES — We report the observation of a highly unusual time-dependent magnetic phenomena in which a transition from one long-range magnetically ordered state to another occurs over a timescale of several hours. We have used powder neutron diffraction to investigate the magnetic structure of Ising spin chain compound $Ca_3Co_2O_6$. Our investigation focuses on the low-temperature regime ($T < 14$ K$<< T_N = 25$ K) where previous neutron diffraction studies have shown that there is an increasing instability in the spin density wave (SDW) order within this material. The results of the present work reveal that there is an order-order transition from the SDW structure to a new commensurate antiferromagnetic phase. The extraordinary time dependence of the magnetic reflections demonstrates that this transition occurs via a very slow transformation process. As the temperature is reduced the characteristic time of the transition process increases rapidly and at low temperatures the magnetic states become frozen. Calculations show that the commensurate AFM phase has a lower exchange energy than the SDW structure and is therefore expected to be ground state of $Ca_3Co_2O_6$. Our neutron data confirm the theoretical predictions, but also show that the SDW phase is preferred for 12 K $< T < T_N$.

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