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Pressure effects on the magnetic behavior of the local moment ferromagnet CeCuSi

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Abstract content ** ** (Max 300 words) **
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Interest in Ce or U based ternary intermetallics has been ongoing for the last three decades, because they show a variety of exotic magnetic-electronic ground-states (e.g. heavy fermion behavior, non Fermi-liquid characteristics, etc). Most magnetic Ce-TX compounds order antiferromagnetically (T is a transition metal and X is a p-band element). One candidate, CeCuSi, is among a select number that exhibits ferromagnetic ordering at low temperatures; other candidates being CePdX (X = P, As, Sb). The ferromagnetic transition in this compound has been established from both specific heat data (λ -type anomaly manifested at $T_C = 15$ K) and magnetization measurements in which an ordered moment of $\sim 1 \mu_B$ has been obtained. The hybridization (J) between the localized $4f$ and more extended d orbitals (Ce $5d$ and T $3d$), which influences intersite magnetic ordering of Ce moments via the RKKY indirect interaction mechanism involving the d conduction electrons, is readily tuned under pressure. Consequently new ground states can be stabilized at reduced inter-atomic spacing without the complexity of disorder from doping. Many well known antiferromagnetic Ce-TX compounds have been the focus of attention in pressure studies in the last decade. There has been much less done, if any, in elucidating the pressure response of *ferromagnetic* analogs. We present the results of our pressure studies on the title compound. These studies have entailed: (i) SQUID magnetization measurements to ~ 10 GPa in a turn-buckle magnetic diamond anvil cell (TM-DAC) to monitor both T_C and magnetic susceptibility, (ii) x-ray absorption spectroscopy (XAS) at the Ce $L_{3/2}$ -edge (~ 5.7 keV) to pressures of ~ 16 GPa. The latter necessitates use of "perforated" diamond anvils in a membrane-DAC for both a near edge spectroscopy (XANES) probe of Ce valence and x-ray absorption dichroism (XMCD) at 6 K to monitor shell-specific $5d-3d$ conduction electron spin polarization in the magnetically ordered state. We evidence increasing T_C values (from 15 K to 30 K), and yet collapse of the XMCD signal, with rising pressure up to 10 GPa; beyond which signatures of a valence change are manifest in the XANES profiles.

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Yes

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