Effect of localization of 5f-electrons and pressure on magnetism in uranium intermetallics in spin-fluctuation theory

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UCoGa and URhGa, two isostructural compounds, show opposite signs of the initial response of Curie temperature to applied hydrostatic pressure. To determine the physical origin of this difference the magnetization data measured with respect to temperature, magnetic field, and hydrostatic pressure were analyzed in the framework of the Takahashi spin-fluctuation theory. The parameters T_0 and T_A characterizing the distribution widths of the spin-fluctuation spectrum in the energy and wave-vector space, respectively, and T_C/T_0, the degree of the 5f-electron localization, have been determined. Examination of available experimental data for the other UTX (T = a transition metal, X = Al, Ga) ferromagnets having the ZrNiAl-type structure revealed some correlations between the degree of the 5f-electron localization represented by the spin-fluctuation parameters and the response of Curie temperature on the applied pressure. The extent to which this correlation can be used to describe the localization and magnetic behavior of other uranium ferromagnetic compounds is discussed.

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I. INTRODUCTION

Nowadays, ferromagnetic quantum criticality is a heavily studied phenomenon. Hydrostatic pressure acting on the studied material has proven to be a suitable parameter for tuning magnetic state.

In the present study, we focus on a group of compounds from the UTX family (T- transition metal; X- p metal) crystallizing in the hexagonal ZrNiAl structure. Many of these compounds are ferromagnetic with a relatively large span of Curie temperatures and magnitudes of ordered moments [1] and may therefore be used to study discontinuous phase transitions with variable parameters of magnetic order, yet with a fixed crystal structure. In several of these compounds the presence of a discontinuous phase transition has been recently confirmed (e.g., UCoAl [2,3], URhAl [4], UCoGa [5]). On the other hand, two members of this group, UPtAl [6] and URhGa [7], respectively, show an initial (in the range of several GPa) increase of T_C with increasing pressure. It is therefore desirable to be able to predict the pressure behavior of T_C in these compounds.

In this paper, Takahashi's spin-fluctuation theory (TSFT) [8] is used to determine if an increasing T_C with increasing pressure can be expected. In this theory, the total amplitude of the local spin fluctuations (SF) is constant as a function of temperature. This enables one to determine the value of F_1, the mode-mode coupling term as the coefficient of the M^4 term in the Landau expansion of the free energy,

$$F_m(M) = F_m(0) + \frac{1}{2(g\mu_B)^2\chi}M^2 + \frac{F_1}{4(g\mu_B)^4 N_0^3}M^4, \quad (1)$$

and the values of T_0 and T_A, which represent the distribution widths of the SF spectrum in energy and wave-vector space, respectively,

$$\left(\frac{T_C}{T_0}\right)^{5/6} = \frac{M_s^2}{5g^2C_{4/3}}\left(\frac{15cF_1}{2T_C}\right)^{1/2}, \quad (2)$$

$$\left(\frac{T_C}{T_A}\right)^{5/3} = \frac{M_s^2}{5g^2C_{4/3}}\left(\frac{2T_C}{15cF_1}\right)^{1/3}, \quad (3)$$

where g is the gyromagnetic ratio, μ_B is the Bohr magneton, N_0 is the Avogadro number, M_s is the spontaneous magnetic moment, $C_{4/3}$ is constant ($= 1.006\,089\cdots$) and $c = 1/2$. The value of F_1 is determined from the slope of the Arrott plot (M^2 vs M/H) at low temperatures [8]. The ratio T_C/T_0 corresponds to the degree of localization of the electrons responsible for the magnetization and ranges from $T_C/T_0 = 1$ for the entirely localized case to $T_C/T_0 \to 0$ for completely delocalized [8].

The compounds targeted by the study are UCoGa, with $T_C = 48$ K [9,10] and T_C decreasing with applied pressure [5], and URhGa with $T_C = 41$ K [10] and T_C increasing with pressures up to 6 GPa [7]. The analysis of magnetization data observed at ambient pressure reveals a clear difference of the corresponding F_1, T_0, T_A, and T_C/T_0 values obtained for the two UTX compounds. A considerably higher degree of 5f-electron localization (higher T_C/T_0) in conjunction with the narrower SF spectrum both in energy and wave-vector space (smaller T_0 and T_A) have been documented for URhGa in comparison with UCoGa. The results of the analysis of pressure-induced changes of F_1, T_0, T_A, and T_C/T_0 corroborate the proposed scenario of $dT_C/dP > 0$ for URhGa in contrast to $dT_C/dP < 0$ for UCoGa. The evolution of dT_C/dP of the

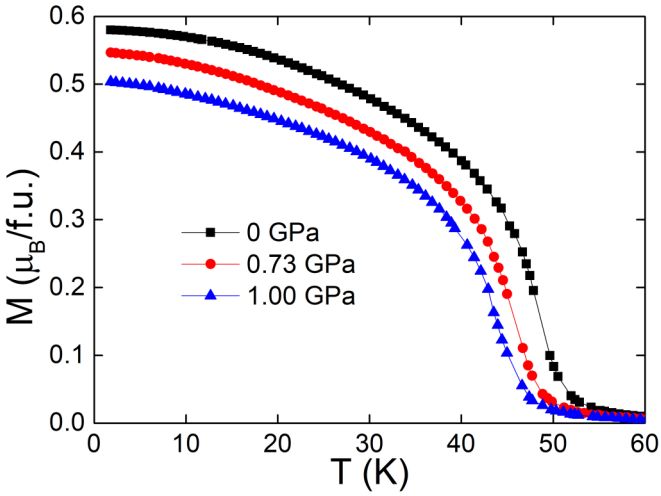

FIG. 1. Temperature dependence of the magnetization of UCoGa at different pressures, in an applied field of 0.1 T.

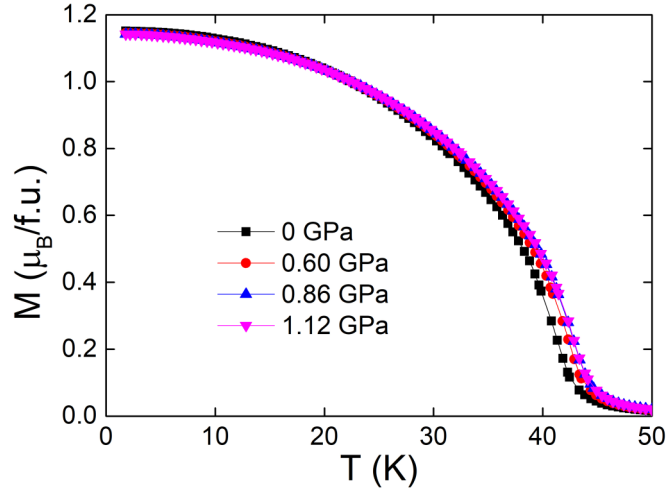

FIG. 2. Temperature dependence of the magnetization of URhGa at different pressures, in an applied field of 0.1 T.

hexagonal U*TX* ferromagnets with the ZrNiAl-type structure including UCoGa and URhGa reveals correlation with T_C/T_0 ratio across this isostructural series. A discussion focused on a comparison with the corresponding data known for orthorhombic U*TX* ferromagnets and UGe_2 indicates that the above correlation does not have universal validity for all U ferromagnets.

II. EXPERIMENT

Single crystals of UCoGa and URhGa were prepared by the Czochralski method using a triarc furnace. For UCoGa, details of the single-crystal preparation and annealing are presented elsewhere [11]. URhGa was grown with a pulling speed of 12 mm/h. The ingot was wrapped in tantalum foil and annealed at 900 °C in an evacuated quartz tube. Magnetization measurements at ambient and hydrostatic pressures were performed in an MPMS XL 7T magnetometer (Quantum Design). Since the U*TX* compounds crystallizing in the hexagonal ZrNiAl structure exhibit huge uniaxial magnetocrystalline anisotropy with the entire magnetic moment concentrated to the *c* axis [1] only the magnetization data for this field direction were measured and used for the presented analysis. For pressure experiments, a small CuBe hydrostatic cell [12] was used, with Daphne 7373 oil as a pressure medium. The superconducting transition of Pb was used to determine the pressure in the cell at low temperatures.

III. RESULTS AND DISCUSSION

The temperature dependencies of the magnetization of UCoGa and URhGa measured in a low applied field (0.1 T) at various pressures are shown in Figs. 1 and 2, respectively. The values of Curie temperature (T_C) were estimated as the temperature of the inflection point of these thermomagnetic curves. For UCoGa, T_C decreases while for URhGa T_C increases with increasing pressure in agreement with earlier high pressure studies [5,7]. The phase transition in both compounds at ambient pressure is continuous (a second-order transition).

The magnetization isotherms of UCoGa and URhGa were measured at 1.8 K, at the same pressures as the corresponding temperature dependencies of thermomagnetic curves (Fig. 3).

The values of spontaneous magnetization (M_s) were obtained by extrapolating the parts (above 1 T in order to avoid effects related to domains and superconducting phase of Pb) of magnetization curves to zero magnetic field. The M_s values obtained for UCoGa and URhGa at different pressures are listed in Table I. In the case of UCoGa M_s is clearly decreasing with increasing pressure, whereas the M_s of URhGa decreases only slightly between 0 and 0.6 GPa, and remains unchanged with higher pressures up to 1 GPa.

The Arrot plots of UCoGa and URhGa magnetization data, for all pressure points, are shown in Fig. 4. The slopes of the plots determined by linear regression and the values of M_s and T_C were used to determine values of the TSFT parameters F_1, T_A, T_0, and T_C/T_0 at different pressure points, and are shown in Table I and Fig. 5.

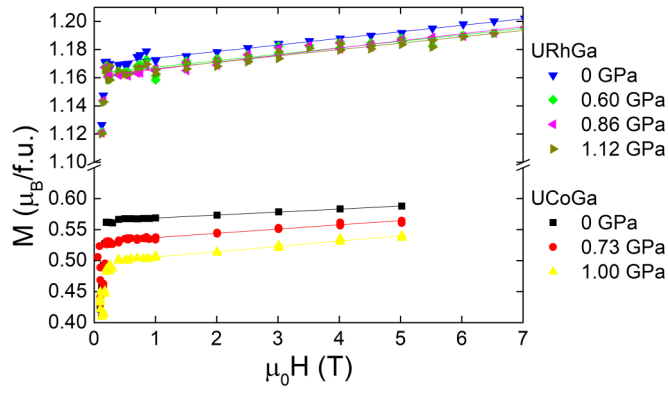

FIG. 3. Magnetization curves of UCoGa and URhGa measured at 1.8 K in magnetic fields applied along the *c* axis at various pressures with contribution from pressure cell already subtracted. The contribution from the pressure cell was determined by comparing data in 0 GPa and ambient pressure. Lines are used as a guide to the eye.

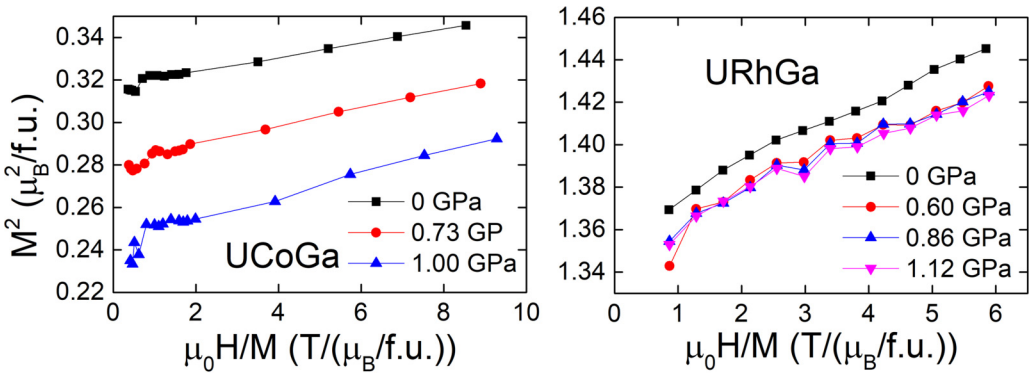

FIG. 4. The Arrot plots of magnetization isotherm data UCoGa and URhGa measured at different pressures.

To facilitate the discussion of these parameters, and their development with pressure, the complexity of the role of U 5f-electrons on the electronic structure and magnetism should be taken into account. The variable dual character of the 5f-electrons of U ions (partially localized, partially itinerant) [13–15] found in various crystallographic and chemical environments in U compounds, is reflected in the wide range of their observed magnetic behaviors. The 5f wave functions are widely extended in space and allow strong 5f-ligand hybridization in the compounds, which destroys the original atomic character of the 5f wave functions and the related magnetic moments. In the strong hybridization limit, the 5f magnetic moments vanish and magnetic order is lost. The 5f-ligand hybridization, however, may also enforce the magnetic ordering because it mediates the indirect exchange interaction of pairs of 5f-electron magnetic moments born at U ions via the involved ligand [1]. In materials in which the 5f-ligand hybridization is not too strong, the 5f moments remain stable and increasing hybridization enhances the exchange interaction and causes an increase in T_C. The 5f-ligand hybridization originates from overlaps of the U 5f wave functions, with the wave functions of ligand valence-electrons and depends critically on the distances between involved ions. Thanks to compressibility, interatomic distances, and consequently the 5f-ligand hybridizations, can be controlled by external pressure. Isostructural families of materials, such as UTX compounds with a hexagonal ZrNiAl structure, provide a useful playground for testing the effect of ligand species and U-ligand interatomic distances on the degree of 5f-electron delocalization and their implications for critical parameters of magnetic ordering while maintaining constant crystallographic symmetry. UCoGa and URhGa were selected for our study because they represent two groups of UTX compounds characterized by different signs of pressure effect on T_C, quantitatively expressed by $d\ln T_C/dP$ (see Table I). The two compounds have similar values of Curie temperature (T_C = 48.8 and 41.1 K, respectively) but the low-temperature spontaneous magnetization $M_s = 1.16\,\mu_B$/f.u. of URhGa is more than double the $M_s = 0.56\,\mu_B$/f.u. of UCoGa. The strongly reduced U moment in UCoGa is a clear indication of a much stronger delocalization of 5f-electrons, compared to URhGa. Such a situation can be intuitively expected when we take into account the much smaller lattice parameters, in particular the a, in UCoGa with respect to URhGa. Consequently, the corresponding U-U and U-T interatomic distances within the basal plane imply much larger 5f-5f and 5f-3d wave-function overlaps, with stronger 5f-ligand hybridization leading to much more delocalized 5f-electrons in UCoGa.

From the point of view of TSFT, this situation is clearly reflected in the significantly higher magnitude of the T_C/T_0 ratio (= 0.495) obtained for URhGa compared to the T_C/T_0 = 0.182 obtained for UCoGa. A higher T_C/T_0 ratio represents more localized magnetic electrons. Consistently with better localization of the 5f-electrons, the SF spectra for URhGa are

TABLE I. Experimental values of T_C and M_s with calculated values of F_1, T_0, T_A, and T_C/T_0 from TSFT for UCoGa and URhGa at different pressures.

	P (GPa)	T_C (K)	M_s (μ_B/f.u.)	F_1 (K)	T_A (K)	T_0 (K)	T_C/T_0
UCoGa	0	48.8	0.56	3060	1750	267	0.182
	0.73	46.0	0.53	2320	1700	330	0.139
	1	44.5	0.50	1880	1720	424	0.105
URhGa	0	41.1	1.17	741	480	83	0.495
	0.6	42.2	1.16	776	498	85	0.496
	0.86	42.6	1.16	824	508	83	0.512
	1.12	42.8	1.16	853	513	82	0.521

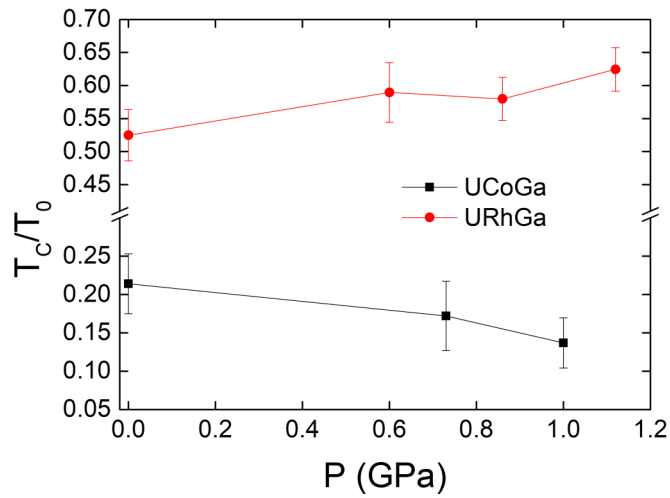

FIG. 5. Pressure dependence of degree of localization, T_C/T_0, for UCoGa and URhGa.

TABLE II. Evolution of room-temperature lattice parameters, ambient-pressure experimental values of T_C and M_s, calculated values of F_1, T_0, T_A, and T_C/T_0 from TSFT, and initial pressure coefficients $\partial \ln T_C/\partial P$ values for $P \to 0$ within a group of isostructural U*TX* ferromagnets crystallizing in the hexagonal ZrNiAl-type structure.

a (pm)	c (pm)	Compound	T_C (K)	M_s (μ_B/f.u.)	F_1 (K)	T_A (K)	T_0 (K)	T_C/T_0	$\partial \ln T_C/\partial P$ G Pa^{-1}
669.1	396.6	$UCo_{0.98}Ru_{0.02}Al$	22.7	0.36	2311	1540	274	0.083	−1.074
669.3	393.3	UCoGa [16]	48.8	0.56	3060	1750	267	0.182	−0.090
695.8	401.4	UIrAl [17,18]	62	0.96	820	861	241	0.257	−0.005
697.0	402.1	URhAl [16,18–20]	26.2	1.05	428	340	64.5	0.365	−0.003
700.6	394.5	URhGa [16]	41.1	1.17	741	480	83	0.495	0.037
701.7	412.4	UPtAl [16,18,21–23]	43.5	1.38	615	395	67.8	0.642	0.059

much narrower both in energy and wave-vector space (smaller T_0 and T_A) than for UCoGa.

In Table I we can also see that the application of hydrostatic pressure on UCoGa and URhGa has a different effect on the corresponding values of M_s, T_C, and the TSFT parameters. With increasing applied pressure on UCoGa, M_s, T_C, and T_C/T_0 decrease rapidly. T_0 increases whereas T_A almost does not change. On the other hand, T_C, T_C/T_0, and T_A of URhGa slightly increase, while M_s and T_0 remain invariant.

These results fit well with the general scenario of relations between electronic structure and magnetism in U compounds, discussed above. URhGa appears in the conditions of moderate hybridization when a pressure-induced increase of hybridization increases the exchange of an interaction leading to an increase of T_C without visible effect on M_s. On the contrary, UCoGa is in a strong hybridization mode, where a significant suppression of the U magnetic moments due to the increasing pressure prevails over the increased exchange integral, so that the T_C and T_C/T_0 decrease rapidly with increasing pressure. From the point of view of TSFT, a decrease of T_C/T_0 means an increasing itinerancy of $5f$-electrons, which leads to an extension of the SF spectrum indicated by an increasing T_0 value.

These are the signatures that URhGa gradually moves towards the strong $5f$-ligand hybridization regime where the washout of U magnetic moments dominates due to increasing itinerancy of $5f$-electrons, so that T_C and also T_C/T_0 will decrease in higher pressures. In Table II, UCoGa and URhGa are compared with several other isostructural U*TX* ferromagnets for which the pressure effects are known. To facilitate further discussion also the lattice parameters are displayed.

When inspecting Table II closely, one can observe a clear relation between the evolution of the lattice parameter a, the spontaneous magnetization M_s, the T_C/T_0 ratio, representing in TSFT the degree of $5f$-electron localization, and the dT_C/dP values. These parameters increase monotonously throughout Table II. The increasing a is directly associated with the proportionally increasing U-U and U-T interatomic distances within the basal plane around which most of the $5f$-$5f$ overlaps and $5f$-d hybridizations occur. Increasing localization of $5f$-electrons can be expected when a increases, which correlates with the increasing T_C/T_0 ratio.

As to the sign of the initial pressure response of T_C, Table II has two parts: (a) URhAl and compounds above it with $\partial \ln T_C/\partial P < 0$ and (b) compounds with $\partial \ln T_C/\partial P > 0$ (URhGa, UPtAl). The limit T_C/T_0 value separating materials with positive to negative pressure response of T_C, respectively, can be roughly estimated as 0.43.

The crossover of the change of $\partial \ln T_C/\partial P$ sign is located between URhAl and URhGa. The opposite signs of dT_C/dP values observed for URhGa (positive) and URhAl (negative) demonstrate that the $5f$-$3p$ (URhAl) hybridization causes a stronger delocalization of the $5f$-electrons than the $5f$-$4p$ (URhGa) hybridization.

URhAl shows an initial slight negative dT_C/dP. The rate of T_C decrease accelerates with increasing pressure towards the loss of ferromagnetism observed at a tricritical point at ∼5.2 GPa [4] (similar to UCoGa [5]).

Investigation of URhGa to higher pressures [7] revealed T_C in URhGa increases linearly ($dT_C/dP \sim 1.1$ K/GPa) whereas dM_s/dP decreases slightly ($dM_s/dP \sim -0.02\,\mu_B$/f.u./GPa) with increasing pressure up to 4 GPa. In higher pressures, dT_C/dP gradually decreases and the pressure, where T_C reaches the maximum value, can be expected somewhere between 6 and 9 GPa. M_s decreases much faster with increasing pressure above 4 GPa ($dM_s/dP \sim -0.08\,\mu_B$/f.u./GPa).

UPtAl also exhibits an increasing T_C with increasing pressure [6,22,23]. T_C reaches the maximum value at 6 GPa and then decreases with further increasing pressure up to ∼17 GPa, where the ferromagnetism is suppressed.

UCoAl, which belongs to the discussed family of isostructural compounds, deserves to be mentioned here too, although it is not ferromagnetic at ambient conditions. It is a paramagnet undergoing a metamagnetic transition in a field applied along the c axis [3,24]. A slight negative chemical pressure accomplished by substituting, e.g., 4% of Lu for U, induces a ferromagnetic ground state [25], whereas application of hydrostatic pressure pushes the metamagnetic transition to higher fields. The study of UCo(Al,Ga) solid solutions [26] revealed the gradual transformation from a paramagnetic ground state of UCoAl to ferromagnetism in UCoGa, with the onset of ferromagnetism around 20% Ga. Detailed investigation on single crystals of selected $UCoAl_{1-x}Ga_x$ compositions is desirable to test the TSFT applied to the evolution of itinerancy of $5f$-electron states in the vicinity of the critical Ga concentration for the onset of ferromagnetism.

So far the discussion was considering experiments involving effects induced by applying hydrostatic pressure. When increasing uniaxial stress is applied on the UCoAl single crystal along the hexagonal c axis a decrease of the critical field of metamagnetic transition (H_c) is observed until it vanishes and a ferromagnetic ordering is established [27,28]. On the other

TABLE III. Evolution of lattice parameters, ambient-pressure experimental values of T_C and M_s, calculated values of F_1, T_0, T_A, and T_C/T_0 from TSFT, and initial pressure coefficients $\partial \ln T_C/\partial P$ values for $P \to 0$ within a group of isostructural UTX ferromagnets crystallizing in the orthorhombic TiNiSi-type structure.

a (pm)	b (pm)	c (pm)	Compound	T_C (K)	M_s (μ_B/f.u.)	F_1 (K)	T_0 (K)	T_A (K)	T_C/T_0	$\partial \ln T_C/\partial P$ G Pa^{-1}
684.66	420.65	722.74	UCoGe [18,35,36]	2.4	0.039	28 700	362	5920	0.007	−0.58
702.3	412.1	745.8	URhSi [18,37,38]	10.5	0.571	520	64.5	354	0.163	∼−0.2
689.79	434.03	753.58	URhGe [18,35,39]	9.5	0.41	1100	78.4	568	0.121	+0.13

hand, the UCoAl crystal is compressed along a; an increase in H_c is observed [29,30].

These results can be understood when we realize that the material exerted to hydrostatic pressure is compressed and interatomic distances in different directions reduced according to the respective linear compressibilities. Uniaxial stress is pushing together atoms along the stress direction whereas the atoms in the perpendicular plane move apart. In the hexagonal UTX compounds adopting the ZrNiAl-type structure the most of the 5f-5f overlaps and 5f-d hybridizations occur around the basal plane which is perpendicular to the c axis. The c-axis uniaxial pressure then leads to better localization of 5f-electrons and hitherto the stabilization of U magnetic moments. As a result, H_c decreases with increasing uniaxial pressure and finally ferromagnetism emerges. This process is boosted by the fact that the compressibility along the a axis is, in this family of compounds, usually several times (∼3 times in UCoAl) larger than that along the c axis [22,31].

It should be noted that the abovementioned a-axis stress experiment [29,30] in the hexagonal UCoAl crystal cannot bring definitive results with respect to this topic. A basal-plane stress experiment, in which the basal plane of the UCoAl crystal is uniformly stressed in all directions whereas the crystal is free to dilate within the c-axis direction, is desirable for affecting the 5f-5f overlaps and 5f-d hybridizations around the plane.

Some of UTX ferromagnets, namely UCoGe, URhGe, and URhSi, crystallize in the orthorhombic structure of the TiNiSi type. The first two of them are the well-known ambient-pressure ferromagnetic superconductors [32,33]. This group of compounds allows us to investigate the extent to which the $T_C/T_0 - \partial \ln T_C/\partial P$ correlation observed in ZrNiAl-type hexagonal family compounds is valid in isoelectronic UTX compounds crystallizing in a lower symmetric structure. In Table III, they are sorted according to increasing values of $\partial \ln T_C/\partial P$.

UCoGe, one of the weakest itinerant 5f-electron ferromagnets UCoGe shows a very small T_C/T_0 value, which is by more than one order of magnitude lower than the value for $UCo_{0.98}Ru_{0.02}Al$. The T_C/T_0 value for URhSi is comparable to the T_C/T_0 value for UCoGa. Similar to $UCo_{0.98}Ru_{0.02}Al$ and UCoGe the Curie temperatures of UCoGe and URhSi decrease with applying hydrostatic pressure. The rate of decrease is four times faster in the case of UCoGe that in URhSi. For UCoGe and URhSi the $T_C/T_0 - \partial \ln T_C/\partial P$ correlation seems to be valid.

URhGe, however, is an obvious exception. Although it shows lower M_s, T_C, and also T_C/T_0 values than URhSi, the response of T_C of URhGe to hydrostatic pressure is positive.

At this point, it is interesting to note that when uniaxial stress is applied on URhGe along the b axis, which is perpendicular to the easy-magnetization direction (c axis), the Curie temperature decreases at a rate $\partial \ln T_C/\partial P \sim -0.17$G Pa^{-1} and simultaneously the critical temperature of superconductivity increases [34].

In Table IV relevant data are shown for the other two U intermetallic compounds (UGe_2, UGa_2) for which sufficient information for the discussion in this paper is available. The first reported uranium ferromagnetic superconductor, orthorhombic UGe_2 [40,41], represents another striking example for which the above-discussed $T_C/T_0 - \partial \ln T_C/\partial P$ correlation is not observed. It exhibits one of the highest values of spontaneous magnetization among U intermetallics and quite high T_C/T_0, both much higher than found for URhGe, but contrary to URhGe it shows a fast decrease of T_C when exerted to hydrostatic pressure.

On the other hand the hexagonal compound UGa_2 [42,43] is probably an example of a uranium intermetallic compound with the most localized 5f-electrons. It has a spontaneous magnetic moment of almost 3 μ_B/U and T_C/T_0 larger than 1. Consistent with expectations, the T_C of UGa_2 increases when the compound is exposed to hydrostatic pressure.

The opposite pressure response of URhGe and UGe_2 Curie temperatures with respect to expectations from the $T_C/T_0 - \partial \ln T_C/\partial P$ correlation observed for the uniaxial UTX ferromagnets adopting the hexagonal ZrNiAl-type structure indicates that the correlation is not a universal feature of U ferromagnets independent from the underlying crystal structure. The reason may be connected with a more complex anisotropy of spin fluctuations in compounds with lower symmetries.

TABLE IV. Ambient-pressure experimental values of T_C and M_s, calculated values of F_1, T_0, T_A, and T_C/T_0 from TSFT, and initial pressure coefficients $\partial \ln T_C/\partial P$ values for $P \to 0$ in UGe_2 and UGa_2.

Compound	T_C (K)	M_s (μ_B/f.u.)	F_1 (K)	T_0 (K)	T_A (K)	T_C/T_0	$\partial \ln T_C/\partial P$ G Pa^{-1}
UGe_2 [18,40]	52.6	1.41	554	92.2	442	0.571	−0.13
UGa_2 [18,42,43]	123	2.94	273	94.8	311	1.12	0.03

The compression of the 5f-electron density towards the basal plane, together with strong spin-orbit coupling in the hexagonal UTX compounds with the ZrNiAl-type structure, are the sources of huge uniaxial magnetocrystalline anisotropy with the easy-magnetization axis along the hexagonal c axis. This makes the magnetism in these materials almost two dimensional. The negligible magnetization observed in the basal plane (perpendicular to the c axis) corroborates the idea that the transversal spin fluctuations are negligible [44] and the spin-fluctuation behavior is simplified. The complex magnetocrystalline anisotropy in the orthorhombic UTX compounds and UGe_2 with different components along the main crystallographic directions together with the anisotropy of compressibility [45] and thermal expansion [46–48] probably does not allow us to apply the model applicable to the hexagonal UTX compounds on these materials.

Further investigation of magnetoelastic behavior of a wider range of U intermetallics is desirable for collecting sufficient amount of information needed for testing possible theoretical approaches.

IV. CONCLUSIONS

The magnetization of UCoGa and URhGa has been measured as a function of temperature, magnetic field, and hydrostatic pressure. The results were analyzed in the framework of Takahashi's spin-fluctuation theory. The TSFT parameters T_0 and T_A characterizing the distribution widths of the SF spectrum in the energy and wave-vector space, respectively, and T_C/T_0 characterizing the degree of the $5f$-electron localization, have been determined for hydrostatic pressures up to 1 GPa. Examination of available experimental data for UTX ferromagnets adopting the hexagonal ZrNiAl-type structure revealed correlations between the degree of $5f$-electron localization, represented by T_C/T_0 parameters, and the response of the Curie temperature on the applied pressure. The T_C/T_0 value of 0.43 has been estimated as the limit separating compounds with lower (higher) T_C/T_0 values and $\partial \ln T_C/\partial P < 0$ ($\partial \ln T_C/\partial P > 0$). Comparison with corresponding data known for the orthorhombic UTX ferromagnets and UGe_2 indicates that the abovementioned correlation does not have universal validity for U ferromagnets outside the ZrNiAl-structure UTX family.

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