state multiplet $J = 5/2$ only so it requires at least the CF acting on $J = 5/2$, $J = 7/2$ and $J = 9/2$ quantum subspace. Note that no intersection has been obtained from the theory published by Liu[3].

A detailed comparison would require a correct description of the exchange interaction in the paramagnetic region above 12.6 K, since the simple molecular-field and CF model was found to provide only a semiquantitative agreement with our experimental data, and is therefore definitely too crude for a description of our measured paramagnetic susceptibility versus temperature data. Furthermore, we therefore also decided not to fit the measured data by a too-crude molecular field and CF model approach.

IV. CONCLUSIONS

We have prepared a single crystal of the $SmPd_2Al_3$ compound in order to study specific features of Sm magnetism. The magnetization, AC susceptibility and specific-heat measurements of the crystal exposed to magnetic fields applied along the principal crystallographic axes revealed a strong uniaxial magnetocrystalline anisotropy (even in paramagnetic state) with a easy magnetization direction in the *c*-axis, which is in contrast to the easy-plane anisotropy reported for other compounds in the $RE\mathrm{Pd_2Al_3}$ group. The four magnetic transitions observed with temperature dependence of the specific heat at temperatures $T_3 = 3.4$ K, $\mathrm{T}_2 = 3.9$ K, $T_1 = 4.4$ K and $T_C = 12.4$ K, respectively, and detected in part also in magnetization, AC susceptibility and electrical resistivity data, point to a complex magnetic phase diagram for $SmPd_2Al_3$. Although this material becomes ferromagnetic below $T_C = 12.4$ K, an antiferromagnetic ground state seems to become established at low temperatures. The series of four metamagnetic transitions detected at 0.03, 0.35, 0.5 and 0.75 T, respectively, underlines the complexity of the Sm magnetism, which is characterized by a small Sm magnetic moment and a complex interplay of crystal-field and exchange interactions. The principal role of CF interaction has been confirmed by ab initio calculations and our comparison of calculated and experimental paramagnetic susceptibility data. To prove the validity of our scenario on the multiphase magnetic diagram, as well as on the magnetic phase transitions indicated in our work suitable microscopic experiments are strongly desired; namely, neutron diffraction and μSR spectroscopy. The high neutron absorption by Sm for a standard thermal neutron wavelength implies that a hot neutron beam would be