

TABLE 2
Physical Properties of Perovskites with d^2 Configuration at the B Cations

Compound	$T_N(^{\circ}\text{K})$	$d\rho/dT^b$	Symm. 300°K	Remarks	Refs.
BaMoO_3	Pauli ^a	> 0	Cubic		15
SrMoO_3	Pauli ^a	> 0	Cubic		15
CaMoO_3	Pauli ^a	> 0	Ortho.		
SrCrO_3	Pauli ^a	> 0	Cubic		3
CaCrO_3	90	< 0	Ortho.	$dT_N/dP = -0.23^{\circ}\text{K/kbar}$	
PbCrO_3	240	< 0	Cubic	Collinear Type-G order $T < T_N$	2
LaVO_3	137	< 0	(Cubic)	Tet. ($c/a < 1$) \neq Cubic at T_N	14
YVO_3	110	< 0	Ortho.	DTA anomaly at $T_t = 73^{\circ}\text{K}$	14

a. Pauli = temperature-independent χ_m and no spontaneous magnetic order.

b. ρ = electrical resistivity; Metallic ($d\rho/dT > 0$) vs semiconducting ($d\rho/dT < 0$).

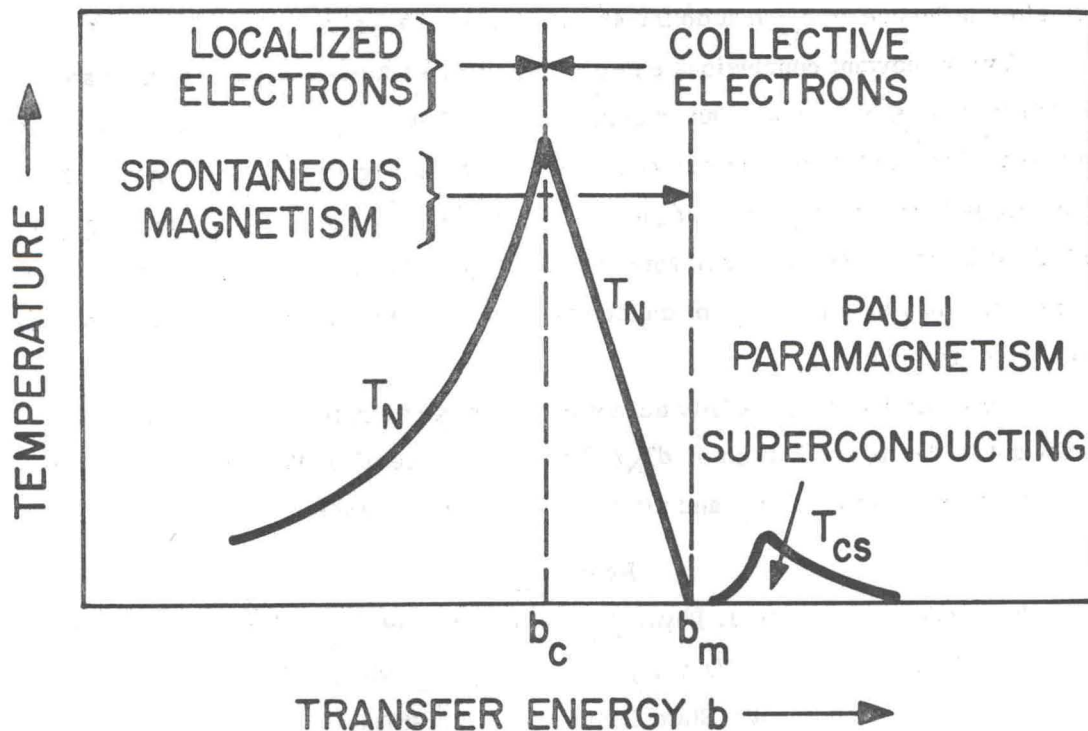


FIG. 2

Electronic phase diagram for one electron per interacting orbital.
Semiconducting for $b_{ij} < b_m$, metallic for $b_{ij} > b_m$.

introduces more covalency in the A-O bond, is largely compensated by the fact that lanthanum is far to the left of lead in the periodic table.

Comparison of Table 2 with the phase diagram of Fig. 2 places SrCrO_3 and AMoO_3 ($A = \text{Ca, Sr, Ba}$) in the domain $b_{ij} > b_m$, PbCrO_3 and CaCrO_3 in the transitional domain $b_c < b_{ij} < b_m$, and the two vanadates LaVO_3 , YVO_3 in the localized-electron domain $b_{ij} < b_c$. The fact that PbCrO_3 remains cubic to lowest temperatures, even though it has a collinear type-G antiferromagnetic order [2], is consistent with collective d electrons. By contrast, LaVO_3 exhibits a tetragonal ($c/a < 1$) to cubic (or O' -orthorhombic to O-orthorhombic, where distortions toward orthorhombic symmetry are very small) transition [14], which is characteristic of spin-orbit coupling and localized d electrons having collinear spins. YVO_3 , which does not undergo a crystallographic transition at T_N , exhibits a definite DTA anomaly at $73^\circ\text{K} < T_N$, which suggests the anticipated O' -orthorhombic to O-orthorhombic transition. Finally, a $dT_N/dP < 0$ for CaCrO_3 is consistent with Fig. 2 and $b_c < b_{ij} < b_m$, since b_{ij} should increase with a pressure-induced decreasing lattice parameter. (Changes in the lattice parameter by chemical means, as in CaCrO_3 vs SrCrO_3 , have a smaller influence on b_{ij} than do the accompanying changes in A-O covalency.)

Two important conclusions emerge from these studies: (1) An intermediate domain $b_c < b_{ij} < b_m$ exists, but is quite narrow. The compounds PbCrO_3 and CaCrO_3 may be said to exhibit spontaneous collective-electron magnetism in contrast to the spontaneous localized-electron magnetism of YVO_3 and LaVO_3 . (2) The fact that CaCrO_3 exhibits parasitic ferromagnetism demonstrates that antisymmetric exchange interactions may be a property of collective-electron magnetism as well as of localized-electron magnetism.

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References

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