Charge and spin order in $Ca_3Ru_2O_7$ under high pressure

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Pure samples of layered ruthenates have opened up new fields of correlated electron research. Like its cousins, triplet superconductors Sr_2RuO_4, its insulating Ca-analogue Ca_2RuO_4 and the metamagnet $Sr_3Ru_2O_7$, the bilayered perovskite $Ca_3Ru_2O_7$ offers the potential for discovery associated with spin or charge order quantum critical points.
Ambient pressure $Ca_3Ru_2O_7$ undergoes, on cooling, a magnetic transition (ferromagnetically aligned spins within the double layer, alternating magnetisation between layers) at $T_N \sim 56$ K, followed by a structural transition at $T_s \sim 48$ K into a low-carrier-density state. We explored the evolution of the in-plane resistivity of high purity single crystals of $Ca_3Ru_2O_7$ grown by a floating zone method with hydrostatic pressure of up to 30 kbar and in magnetic fields up to 9 T.
Both transition temperatures exhibit a strong pressure dependence, extrapolating to 0 K at about 32 kbar (T_s) and 45 kbar (T_N). Moreover, magnetic fields applied in the ab-plane, H, strongly suppress T_N, to the extent that T_N crosses T_S, and induce a third, so far unidentified anomaly at intermediate pressures and fields.