Tunable electronic anisotropy in single-crystal $A_2Cr_3As_3$ (A=K, Rb) quasi-one-dimensional superconductors

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We reported the single crystals of $Rb_2Cr_3As_3$, a member of the newly discovered $A_2Cr_3As_3$ (A=K,Rb,Cs) quasi-one-dimensional superconductor family. A novel self-flux technique was used to successfully grow single crystals of both K2Cr3As3 and Rb2Cr3As3. The physical properties were systematically studied using structural, transport, and thermodynamic measurements to compare and contrast their normal and superconducting state properties. The superconducting state properties between the two species are similar, with critical temperatures of 6.1 and 4.8 K in $K_2Cr_3As_3$ and $Rb_2Cr_3As_3$, respectively. The normal state properties exhibit the emergence of a strong electronic anisotropy in $Rb_2Cr_3As_3$ that suggests a unique electronic tuning parameter is coupled to the interchain spacing in the $A_2Cr_3As_3$ structure.
Because the interchain distance is readily controlled with alkali metal size, this family presents a unique opportunity to study the evolution of low-dimensional properties in both normal and superconducting states in a controllable way. I will present our results on both this family and the newly discovered de-intercalated ACr3As3 system, where removal of alkali metals from the unit cell drives dramatic changes to the electronic properties and the disappearance of superconductivity.

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