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Superconductivity in the vicinity of antiferromagnetic order in CrAs and related materials

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Transition-metal oxides or pnictides are in rich of novel and intriguing electronic behaviors due to multiple quantum orders and competing phenomena. Among the different electronic states, the emergence of superconductivity in the vicinity of other quantum orders is at the heart of the rich physics. Superconductivity has been observed in a majority of 3d transition-metal compounds except for the Cr- and Mn- based compounds. It is thus of high interest in exploring possible superconductivity in those systems. In this talk, I will present the discovery of superconductivity on the verge of antiferromagnetic order in CrAs via the application of external high pressure. Bulk superconductivity with $T_c \approx 2$ K emerges at the critical pressure $P_c \approx 8$ kbar, where the first-order antiferromagnetic transition at $T_N \approx 265$ K under ambient pressure is completely suppressed. In addition, quantum criticality and non-Fermi liquid behavior are observed near P_c, which we interpret as originating from a nearly second-order magnetic quantum phase transition that is concomitant with a first-order structural transition. The present finding opens a new avenue for searching novel superconductors in the Cr and other 3d transitional-metal based systems.

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