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**Extremely large electronic anisotropy caused by electronic phase separation in $Ca_3(Ru_{0.97}Ti_{0.03})_2O_7$ single crystal** JING PENG, Tulane University and Nanjing University, XIAOSHAN WU, Nanjing University, ZHIQIANG MAO, Tulane University — Bilayered ruthenate $Ca_3Ru_2O_7$ exhibits rich electronic and magnetic properties. It orders at 56K, with FM bilayers antiferromagnetically coupled along c-axis (AFM-a). The AFM transition is closely followed by a first-order metal-insulator (MI) transition at 48K where spin directions switch to the b-axis (AFM-b). While this MI transition is accompanied by the opening of anisotropic charge gap; small Fermi pockets survive from the MI transition, thus resulting in quasi-2D metallic transport behavior for T¡30K. We previously showed such a quasi-2D metal with the AFM-b order composed of FM bilayers can be tuned to a Mott-insulating state with a nearest-neighbor AFM order via Ti doping [Ke et al, PRB 84, 201102(11)]. $Ca_3(Ru_{0.97}Ti_{0.03})_2O_7$ is close to the critical composition for the AFM-b-to-G-AFM phase transition. Our recent studies show the sample with this composition is characterized by an electronic phase separation between the insulating G-AFM phase (major) and the localized AFM-b phase (minor). The minor AFM-b phase forms a conducting path through electronic percolation within the ab-plane, but not along the c-axis, thus resulting in extremely large electronic anisotropy with $\rho_{ab}/\rho_c \sim 10^9$, which may be the largest among bulk materials.

Zhiqiang Mao
Tulane University

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