Electronic density of states of Ca₃Ru₂O₇ measured by tunneling spectroscopy

KWOK-WAI NG, ANTHONY BAUTISTA, GANG CAO, University of Kentucky — The ruthenates are perhaps one of the most diverse of group of materials known up to date. These compounds exhibit a wide array of behaviors ranging from the exotic p-wave superconductivity in Sr₂RuO₄, to the itinerant ferromagnetism in SrRuO₃, and the Mott-insulating behavior in Ca₂RuO₄. One of the most intriguing compounds belonging to this group is Ca₃Ru₂O₇ which is known to undergo an antiferromagnetic ordering at 56K and an insulating transition at 48K. We have prepared Ca₃Ru₂O₇/Al₂O₃/Ag planar junctions and used tunneling spectroscopy to study the density of states of Ca₃Ru₂O₇ from room temperature to 4.2K. Distinguish gap structure can be observed in all spectra at temperatures below 48K. The tunneling spectra behave very differently and the gap has dissimilar values along the three crystal axes directions. We have also studied the effect of magnetic field on these spectra by applying an external field up to 7T along the a-axis direction. In this presentation we will summarize our results and discuss their implications in relation to the competition between different interactions in the ground state of this material. This research was supported by NSF grants DMR-0800367, DMR-0856234 and EPS-0814194.

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