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Electron spectroscopic study of correlated transition metal oxides

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The investigation of the role of electron correlation in various electronic properties is a paradigmatic problem in solid state physics. $3d$ transition metal oxides have drawn much attention in this direction during last few decades due to various exotic properties exhibited by these systems. Various recent studies show that $4d$ and $5d$ transition metal oxides (TMO) also exhibit varieties of interesting and unusual properties although the electron correlation strength is expected to be weak due to large radial extensions of the $4d$ and $5d$ orbitals. We have employed high resolution photoemission spectroscopy to study these systems. For example, ruthenates ($4d$ TMO) in the perovskite structure exhibit a transition from Fermi liquid to Non-Fermi liquid behavior and unusual magnetic properties[1], although the electron correlation is found to be significantly weak[2, 3]. Doping of Ti at the Ru sites leads to a transition from weakly correlated metal to a band insulating phase[4] via a half metallic phase[5]. A $5d$ TMO, $BaIrO_3$ exhibits CDW/unusual electronic phase transition despite being an insulator. High resolution photoemission studies show that such unusual ground state appear due to localized electronic states at the Fermi level[6]. Electron correlation strength may not be strong in this system[7]. $Y_2Ir_2O_7$ is proposed to be a Mott insulator although the partially filled $5d$ orbitals are expected to be highly extended[8]. In this talk, I will provide a brief overview of our findings in these systems and try to bring out open questions related to these studies. The details can be found in the following references.

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