Abstract submitted to the
RESEARCH WORKSHOP ON SPIN, CHARGE, AND ENERGY CURRENTS IN NOVEL MATERIALS
October 1 - 7, 2017 Hvar, Croatia

Spin-Orbit Coupling and Electronic Correlations in Sr_2RuO_4

Jernej Mravlje[1], Alen Horvat[1], Rok Žitko[1,2], Minjae Kim[4, 3], Michel Ferrrero[3,4], Olivier Parcollet[4,5], Antoine Georges[3,4,6]

[1] *Jožef Stefan Institute, Jamova 39, Ljubljana, Slovenia*
[2] *Faculty of Mathematics and Physics, University of Ljubljana, Jadranska 19, Ljubljana, Slovenia*
[3] *CPHT, École Polytechnique, CNRS Université Paris-Saclay, 91128 Palaiseau, France*
[4] *Collège de France, 11 place Marcelin Berthelot, 75005 Paris, France*
[5] *Institut de Physique Théorique (IPhT), CEA, CNRS, 91191 Gif-sur-Yvette, France*
[6] *DQMP, Universtity of Geneva, 24 Quai Ernest-Ansermet, 1211 Geneva , Switzerland*

Submitted : 08-09-2017
Keywords : spin-orbit coupling, strong correlations, Hund's metal

The interplay between spin orbit coupling and strong electronic correlations is a topic of high current interest. An important example where both of these play a role is Sr_2RuO_4, a compound with unconventional superconductivity below 1.5K, Fermi liquid behavior below 20K, and incoherent/bad metal behavior at elevated temperatures. This compound was theoretically succesfully described as a Hund's metal, a correlated metal with a coherence scale that is low due to the action of the Hund's rule coupling. An important aspect of this picture is a separation of spin- and orbital- coherence scale: the orbital moments are screened at a higher temperature than the spin moments.

Now, this picture disregards spin-orbit coupling, that is of magnitude λ=0.1eV, as observed also in spin-resolved ARPES experiments. How to reconcile the Hund's metal picture (that, importantly, also led to a high degree of quantitative agreement with experiments) with the a sizeable λ is an important question.

I will describe two sets of results, one from the NRG study of the three-orbital impurity model and one from the realistic DMFT simulation of Sr_2RuO_4. The NRG impurity study shows that the effects of λ are not important until λ exceeds the orbital coherence scale. The realistic DMFT study shows what are the conseqeunces of this for a real material.

[1] A. Horvat, R. Žitko, and J. Mravlje, Phys. Rev. B **96**, 085122 (2017).
[2] M. Kim, J. Mravlje, M. Ferrero, O. Parcollet, and A. Georges, arXiv:1707.02462 (2017).