Doped Spin-Orbital Mott Insulators: Orbital Dilution versus Spin-Orbital Polarons

Andrzej M. Oleś [1,2]

[1] *Institute Theoretical Physics, Jagiellonian University, PL-30348 Kraków, Poland*
[2] *Max Planck Institute for Solid State Research, D-70569 Stuttgart, Germany*

Transition metal oxides with t_{2g} orbital degrees of freedom, $\xi \equiv \{xy, yz, zx\}$, realize competing types of spin–orbital order [1]. Doping of Ru(d^4)–systems by d^3 ions results in orbital dilution and the exchange on hybrid d^4–d^3 bonds modifies locally (or globally) spin–orbital order [2] and may invert crystal field [3]. In contrast, charged (Sr,Ca) defects in RVO$_3$ (R=La,Y) generate spin–orbital polarons seen in the photoemission spectra [4]. We show that rotation of t_{2g} orbitals is induced by the Coulomb interactions near the charged defects and eventually orbital order collapses. We investigate the inverse participation number spectra and find that electron states remain localized on few sites even in the regime where orbital order is collapsed [5]. We conclude that our model gives a qualitative explanation of the decay of orbital order accompanied by robust C-type AF spin order in R_{1-x}(Sr,Ca)$_x$VO$_3$ compounds.

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