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Orbitals, reduced dimensionality and spin gaps in correlated oxides

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Due to directional character of orbitals very often orbital ordering leads to an effective dimensionality reduction. Especially strong are these effects in systems with triply-degenerate t_{2g} electrons. One of the striking consequences thereof is the possibility to form spin-gap states instead of long-range magnetic ordering. Such spin gap states may be formed on dimers, on trimers, on bigger clusters and even on chains. In the talk I will review this question, discuss different situations and different mechanisms of spin gap formation, and illustrate these general ideas on several examples (perovskite KCuF3; spinels MgTi2O4 and CuIr2S4 [1]; pyroxene NaTiSi2O6 [2]; layered systems La4Ru2O10 with square [3], LiVO2 with triangular [4], Li2RuO3 with honeycomb lattices [5], pyrochlore Tl2Ru2O7 [6])

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