(Invited) Highly unusual, doubly-strongly-correlated, altermagnetic 3D analogue of parent compounds of high-Tc cuprates

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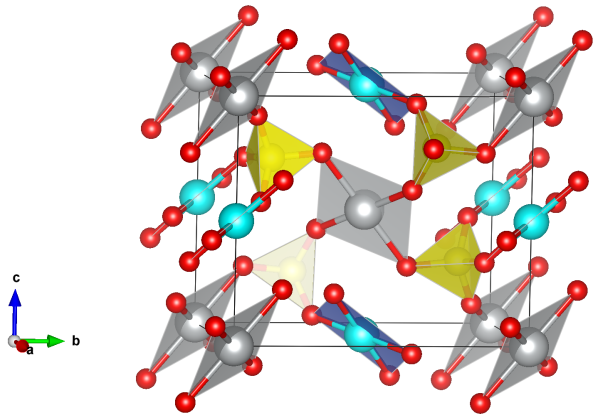
Magnetism | Superconductivity | Correlations | Altermagnetism |

Discovery of high-temperature superconductivity (HTSC) in strongly correlated cuprates opened a new chapter in condensed matter physics, breaking existing stereotypes of what is a material base for a good superconductor, at the same time emphasizing richness and challenge of strongly correlated physics, personified by the most strongly correlated 3d ion, Cu2+. A recently reported new compound, CuAg(SO4)2, combines in a fascinating way the same ion with the most strongly correlated 4d one, Ag2+. In this talk, we present a detailed analysis of electronic and magnetic properties of this material, and show that it is very different from the HTSC cuprates in several different and exciting ways, and opens a door into further research of superconductivity and magnetism, in particular altermagnetism, in strongly correlated materials. The comparison with the HTSC cuprates is summarized in the table below:parent cuprates (PC), CuAg(SO4)2 (CAS)strongly correlated species> PC: one (Cu), CAS - two (Cu, Ag)excitation gap> PC: intermediate, closer to charge transfer (CT), CAS - strongly CTleading superexchange path> PC: Cu–O–Cu, CAS: M–SO4–Mleading superexchange neighbors> PC: first, CAS: 3rd, 5th and 6thleading superexchange length?> PC: ?2.7–2.8 A, PC: 5.7, 6.0, 4.7 Adimensionality> PC: 2D, CAS: 3Dleading spin fluctuations> PC: q = (?, ?), CAS: q = (0, 0, 2?)§altermagnetism> PC: sometimes†, CAS: yes‡? in order of decreasing strength; § in the extended Brillouin zone, corresponding to the intracell magnetic order; †in La2CuO4 and similar materials, due to O octahedra rotations; ‡ regardless of the presence of ligands.



Crystal structure of CAS

References

https://arxiv.org/abs/2403.02201