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Magnetic and electronic properties of 2D metal-organic networks

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Molecular magnetism is an emerging field with potential for technological applications as high-density information storage, quantum computing and spintronics.[1] 2D metal-organic networks are of especial interest since they allow the ordering of magnetic atoms in regular patterns. These systems are highly versatile with endless possible combinations of organic linkers and metallic atoms. We have investigated two kinds of systems: lanthanide metal-organic networks and π-conjugated networks.

By one side, molecular systems based on lanthanides are especially promising due to the fundamental properties of lanthanides. Their strong spin-orbit coupling can lead to a high magnetic anisotropy while the strong localization of 4f states reduces the hybridization with surfaces increasing spin lifetimes.[2] Our pioneering investigations of metal-organic networks coordinated Er and Dy show that it is possible to tailor the magnetic properties and electronic of lanthanides by a proper choice of molecular linkers and metallic centers.[3],[4] The orientation of the easy axis of magnetization and the intensity of the magnetic anisotropy are strongly dependent on the metallic center and the molecular linker.

On the other side, π-conjugated metal-organic networks coordinated with 3d metals can present exotic quantum phases as superconductivity,[5] flat-band,[6] and quantum spin liquid.[7] The conjugation also enhances the coupling between magnetic moments and can lead to antiferromagnetic ground states. We have employed conjugated molecular linkers coordinated with Co to prepare metal-organic networks that present very narrow band-gaps. The experimental results are compatible with antiferromagnetism and one of the investigated systems also presents a large unquenched orbital magnetic moment, unprecedented in 2D transition metal-organic networks.

References:

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