Highlights

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Tunable spin polarization and superconductivity in engineered oxide interfaces

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In the study published on Nature Materials the CNR-SPIN researchers realized a new kind of 2DEG that possesses, besides a superconducting ground state, a strong spin-polarization. The result was obtained by inserting two atomic layers of the antiferromagnetic and insulating compound $EuTiO_3$ between $LaAlO_3$ and $SrTiO_3$. The resulting heterostructures shows at the same time a robust ferromagnetic transition at a Curiè temperature of 8 K and a superconducting transition below 150 mK. Using a prototype field effect device, the researchers showed that the degree of spin-polarization and the superconductive critical temperature can be both controlled by the electron carrier density of the 2DEG. As a consequence, the system is characterized by a complex phase diagram superconductivity emerges from a ferromagnetic normal state.
This result has important implication for the potentialities of these materials in the field of oxide electronics alternative, at least in some particular cases, to the traditional semiconducting silicon based technology and to the new emerging 2D-materials 2D of interest in spintronics.

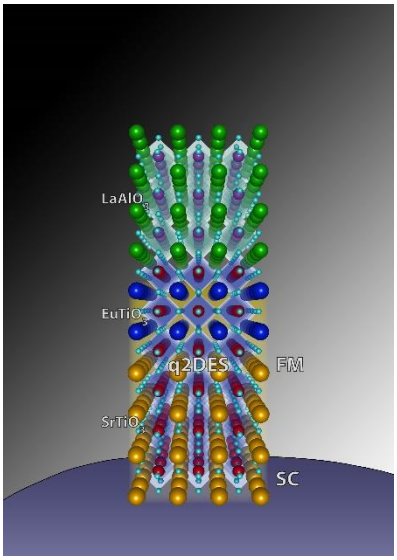

Figure 1. A sketch of the novel spin-polarized q2DEG obtained by embedding a FM $EuTiO_3$ between $LaAlO_3$ and $SrTiO_3$.

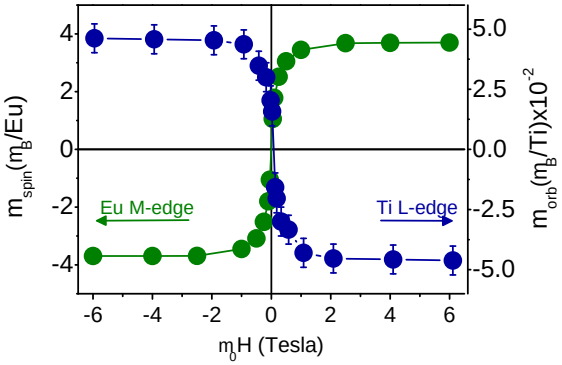

Figure 2. Eu spin moment and Ti orbital moment measured by XMCD at 2 K, showin a link between ETO magnetism and 2DEG spin-polarization