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Interface-induced magnetism and strong correlation in oxide heterostructures

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Two-dimensional electron gases (2DEGs) at interfaces between two insulating oxides have attracted significant attention because they can exhibit unique properties, such as strong electron correlations, superconductivity and magnetism. In this presentation, we will discuss the emergent properties of 2DEGs in $SrTiO_3$ quantum wells that are interfaced with Mott insulating rare earth titanates ($RTiO_3$). We show that the magnetic properties of the 2DEG can be tuned to be either (incipient) ferromagnetic or (incipient) antiferromagnetic, depending on the specific $RTiO_3$ that interfaces it. The thickness of the quantum well is a critical tuning parameter and determines the onset of magnetism, the proximity to a quantum critical point, and the onset of non-Fermi liquid behavior for those quantum wells that are in proximity to an antiferromagnetic transition. We will also discuss the role of symmetry-lowering structural transitions in the quantum well.