Physics of the interface

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There has been an enormous increase in the interest to understand the nature of interface states, following the discovery of a 2-dimensional metallic state at the interface of two highly insulating oxide materials. Subsequent experiments have shown a large number of entirely unexpected properties associated with this 2-d system. Not only such esoteric cases, various 2-d interfacial states play crucial roles in a number of practical devices as well, including semiconductor nanomaterials with unusually high quantum efficiency for optical properties. Role of such buried interfaces can be investigated meaningfully only by a handful of techniques, with the most direct information extractable from Photoelectron spectroscopy. I shall discuss some of the recently studied systems where the dominant property of the sample is controlled by such interfaces and present results that clarify the role of the interface in giving rise to such properties. Specifically, I shall discuss three classes of systems, namely LaAlO3/SrTiO3, magnetic tunnel junctions based on CoFeB/Mgo/CoFeB magnetic structures, and highly luminescent semiconductor nanocrystals.