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Competition of magnetism and Kondo physics in heterostructures

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Heterostructures made of atomically thin strongly correlated materials have been the focus of intense experimental and theoretical study. We report on results obtained using an unbiased numerical technique on a simple model of a metal-magnetic insulator interface: a multilayer system governed by a tight-binding Hamiltonian in which the interaction is nonzero on one set of adjacent planes and zero on another. As the interface hybridization is tuned, magnetic and metallic properties undergo an evolution that reflects the competition between antiferromagnetism and (Kondo) singlet formation, in a scenario similar to that occurring in heavy-fermion materials. Remarkably, for a few-layer system at intermediate hybridization, a Kondo insulating phase results, where magnetic order and conductivity are suppressed in all layers. As more insulating layers are added, magnetic order is restored in all correlated layers except the one at the interface and no evidence of long-range magnetic order induced in the metallic layers is found.