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Tunable ferroelectricity and magnetoelectricity at the interfaces of superlattices of antiferromagnets

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In heterostructures composed of transition metal oxides, the disruption introduced even by an ideal interface can drastically upset the delicate balance of the competing interactions among electronic spins, charges and orbitals, leading to a range of exotic phenomena. These include interfacial conduction, magnetism, superconductivity but also improved ferreoelectric properties. Possible incorporation of magnetoelectrics in these structures would further enable electrical control of magnetization as well as magnetic sensing of the polarization state. Naturally occurring magnetoelectrics are however, rare and generally with weak coupling. In this work we report a strategy and evidence for the emergence and control of ferroelectricity and strong magnetoelectric coupling in superlattices *consisting of solely non-ferroelectric antiferromagnetic layers*. By selecting appropriate yet abundant starting materials one may now design a plethora of low dimensional heterostructures with the desired relative arrangement of the oxide layers, of potential utility to miniature valves with electric and magnetic field tunable functions, promising to set new standards in future electronics.