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McGroddy Prize Talk: Competing orders and gigantic responses in transition-metal oxides with correlated electrons

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Transition-metal oxides offer an intriguing playground to find amazing electronic property/functionality, such as high-temperature superconductivity in copper-oxides and colossal magnetoresistance in manganese-oxides. In those materials, a vast number of electrons, comparable to the number of the constituent atoms, are strongly interacting with each other and tend to lose their mobility. These correlated electrons with internal degrees of freedom- charge, spin, and orbital-, when placed on the specific topological atomic lattice, may form the rich and complex phases or the self-organized structures. Those are, for example, charge- spin stripes, charge-orbital ordered states, and liquid-crystal like states with anisotropic charge-spin-orbital correlations. Here I would present some of ample examples of the correlated-electron's ordering patterns and show how dramatically they can respond to external stimuli, say, electric/magnetic fields, light, and pressure. In particular, the response of correlated electrons can be huge and fast in the vicinity of the boundary of the competing electronic phases, which promises future application.