Enhancing Oxide Properties—The Approach of the Modern Alchemist

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The focus of this talk will be the creation of a new tunable microwave dielectric with record performance at frequencies up to 120 GHz. This is achieved by energizing a low-loss dielectric host with a highly tunable ground state arising from the emergence of a local ferroelectric instability. In contrast to traditional methods of modifying ferroelectrics—doping or strain—in this rather unique system increasing the separation between the $(SrO)_2$ planes bolsters the local ferroelectric instability. This new control parameter, n, can be exploited to achieve a figure of merit at room temperature that surpasses all known tunable microwave dielectrics. I will end by showing a few results from a new direction we* have embarked on—the combination of reactive molecular-beam epitaxy (MBE) to create oxide structures customized at the atomic-layer level with the *in situ* measurement of their electronic structure by angle-resolved photoemission spectroscopy (ARPES).

* = in collaboration with the group of Kyle Shen (Physics, Cornell)