Strongly correlated oxides in ultrahigh electric fields

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Electric double layer (EDL), a nano-gapped capacitor self-organized at the solid-liquid interfaces, is an electrochemical concept proposed by Helmholtz 150 year ago. Because of its large capacitance and high density charge accumulation, EDL has been used in market as capacitor devices, called Supercapacitor or EDLC. We used EDL as a gate dielectric of a transistor device, which is named as EDL transistor (EDLT), and have demonstrated quantum phase control taking the advantage of the electric filed at EDL, which is higher than 10 MV/cm, and difficult or impossible to realize in the solid state devices. In this talk, we describe a basic concept of EDLT, followed by a review of the electric field induced superconductivity and Mott transistors of transition metal oxides using EDLT.

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