Functionality-oriented properties induced by strong electronic correlations

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This talk is focused on a pair of functionality-oriented properties arising from strong electronic correlations (SCE). Its first part is motivated by the long sought size reduction of micro-electronics components and we show that SCE may help reaching it. With this goal we consider capacitors made of a dielectric material surrounded by metallic plates. As emphasized in Ref.[1], negative electronic compressibility of the plates leads to an enhancement of the capacitance of such a capacitor as compared to non-interacting plates, thereby allowing for size reduction. A series of situations where this happens has been recently discovered [2, 3, 4], that we review.

The second part of the talk is motivated by resistive switching, which is central to reduce the energy consumption arising from the training of neural networks, for instance. To that aim we address spin and charge ordered phases entailed in an extended half-filled Hubbard model [5]. Their sensitivity on the crystal field, as well as on local and non-local interactions will be discussed. We furthermore present the discontinuous transitions harbored in this model, together with their connection with resistive switching. The latter is shown to occur in a model presented in the first part as well [4].

References:

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