

Mott Insulators vs Charge Order

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We discuss one of the still not well known aspects of rich physics of the quarter-filled strongly correlated electronic systems[1], represented by the competition of two characteristic insulators, Mott insulator and charge order. The difference between the charge order and the Mott insulator lies in **whether the spontaneous translational symmetry breaking is required or not** in its origin; charge ordering is driven by the strong inter-site Coulomb interactions which spontaneously breaks the system's translational symmetry through an Ising-type of transition. On the other hand, if we introduce in advance *by hand* the non-spontaneous symmetry breaking of two-fold periodicity, the quarter-filled system becomes effectively half-filled. Then, it could become a "Mott insulator" due to the strong Coulomb interaction. Such external breaking of symmetry shall be realized by the dimerization[2], alternating on-site potentials[3], *etc.* The resultant electronic states must be examined theoretically with care by taking fully into account the electronic correlations, which we demonstrate numerically for both the extended Hubbard and the spinless fermionic models in one- and two-dimensions. The difference of the electronic structures, their origin, and the nature of the phase transitions will be reported.

The above mentioned difference between the charge order and Mott insulator would become obvious, once the dynamics of charges are considered. The dimer-Mott insulators are interpreted as "*quantum dipoles*" which are the quantized dipolar moments fluctuating under the transverse field. This picture is in sharp contrast to the charge order which can be regarded as a static ferroelectric assembly of dipolar moments[4]. The relevance of this physical picture with the recent experimental findings [5] on the dimer-Mott insulators, κ -ET₂Cu(CN)₃ and β' -ET₂ICl₃ are discussed.

We also refer to our aim in search of a new class of insulator in between the conventional charge order and Mott insulator.

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