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Theory of non-linear doublon production in a Mott insulator

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We theoretically study the production of doublon-hole pairs in a Mott insulator in strong off-resonant electric fields which takes place due to non-linear effects, i.e., multi-photon absorption and quantum tunneling[1]. This is a many-body extension of Keldysh's ionization theory and the Schwinger mechanism in non-linear QED, and is applied to the one dimensional Hubbard model by combining Bethe ansatz with Landau-Dykhne's quantum tunneling theory. Using this scheme, we show that the distribution of doublon-hole pairs depend on the laser photon energy drastically (Fig.1). We also compare the results with time dependent DMRG.

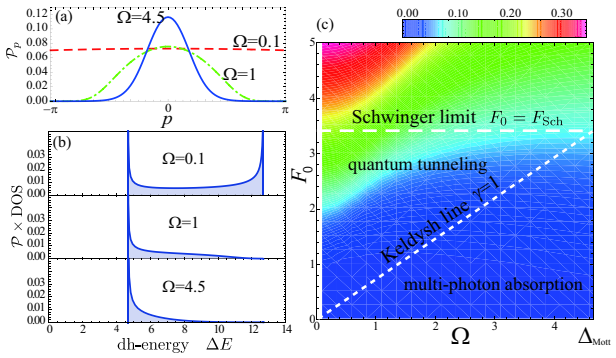

Figure 1: (a)(b) Momentum and energy resolved tunneling probability for $F_0 = 2$ and $\Omega = 0.1,\ 1.0,\ 4.5$ for the $U = 8$ half-filled Hubbard model in AC-electric fields. (c) Total production rate per half cycle $P_{\rm tot}$.

[1] T. Oka arXiv:1105.3145.