
ZAJEDNIČKI SEMINAR INSTITUTA ZA FIZIKU I FIZIČKOG ODSJEKA

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Non-linear electric transport in graphene

Dr. Balazs Dora

Max-Planck-Institut für Physik komplexer Systeme, Dresden, Germany
Department of Physics, Budapest University of Technology and Economics, Budapest, Hungary

We present a unified view of electric transport in undoped graphene for finite electric field. The weak field results agree with the Kubo approach. For strong electric field, the current increases non-linearly with the electric field as E^(3/2). As the Dirac point is moved around in reciprocal space by the field, excited states are generated. This is analogous to the generation of defects in a finite-rate quench through a quantum critical point, which we account for in the framework of the Kibble-Zurek mechanism. These results are also recast in terms of Schwinger's pair production and Landau-Zener tunneling. Other systems exhibiting a band structure with Dirac cones, in particular cold atoms in optical lattices, should exhibit the same dynamics as well.

Voditelj seminara FO
Hrvoje Buljan, hbuljan@phy.hr
