ID de Contribution: **42** Type: **Contribution orale**

Mesoscopic Klein-Schwinger effect in graphene

mercredi 5 juillet 2023 10:15 (15 minutes)

Vacuum breakdown by particle-antiparticle pair creation under intense electric field, introduced by Sauter and Schwinger, is a basic non-perturbative prediction of quantum electrodynamics. Its high-energy physics experimental demonstration remains elusive as the threshold electric fields are extremely strong and beyond current reach, even for the light electron-positron pairs.
Here we put forward a mesoscopic variant of the Schwinger effect in graphene, which hosts Dirac fermions with an approximate electron-hole symmetry. Using DC transport and radiofrequency noise measurements, we report on universal one-dimensional Schwinger conductance at the pinchoff of ballistic graphene transistors. Strong pinchoff electric fields are concentrated within approximately 1µm of the transistor's drain; they generate a giant Klein collimation that acts as a seed for 1D Schwinger electron-hole pair creation at saturation. The theoretical prediction for 1D Schwinger effect is quantitatively verified in its full non-perturbative development. These observations give clues to current saturation limits in ballistic graphene, and pave the way for further quantum electrodynamics experiments in the laboratory.

Affiliation de l'auteur principal

Laboratoire de Physique de l'Ecole Normale Supérieure

Auteur principal: SCHMITT, Aurélien (LPENS-CNRS)

Co-auteurs: M. VALLET, Pierre (LOMA); Dr MELE, David (LPENS-CNRS); Dr ROSTICHER, Michael (LPENS-CNRS); Prof. TANIGUCHI, Takashi (NIMS); Prof. WATANABE, Kenji (NIMS); Prof. BOCQUILLON, Erwann (Universität zu Köln); Prof. FÈVE, Gwendal (LPENS-CNRS); Prof. BERROIR, Jean-Marc (LPENS-CNRS); Prof. VOISIN, Christophe (LPENS-CNRS); Prof. CAYSSOL, Jérôme (LOMA); Prof. GOERBIG, Mark-Oliver (LPS-Orsay); Prof. TROOST, Jan (LPENS-CNRS); Prof. BAUDIN, Emmanuel (LPENS-CNRS); Prof. PLAÇAIS, Bernard (LPENS-CNRS)

Orateur: SCHMITT, Aurélien (LPENS-CNRS)

Classification de Session: Mini-colloques: MC20 Physique mésoscopique

Classification de thématique: MC20 Physique mésoscopique