[1] *Ristivojevic Z.*
Excitation spectrum of Lieb-Liniger model.
arXiv:1403.3415 [cond-mat.quant-gas] (2014).
We study the integrable model of one-dimensional bosons with contact repulsion. In the limit of weak interaction, we use the microscopic hydrodynamic theory to obtain the excitation spectrum. The statistics of quasiparticles changes with the increase of momentum. At lowest momenta good quasiparticles are fermions, while at higher momenta they are Bogoliubov bosons, in accordance with recent studies. In the limit of strong interaction, we analyze the exact solution and find exact results for the spectrum in terms of asymptotic series. Those results undoubtedly suggest that fermionic quasiparticle excitations actually exist at all momenta for moderate and strong interaction, and also at lowest momenta for arbitrary interaction. Moreover, at strong interaction we find highly accurate analytical results for several relevant quantities of Lieb-Liniger model.

[2] *Rozhkov A.V.*
One-dimensional fermions with neither Luttinger-liquid nor Fermi-liquid behavior.
Phys. Rev. Lett. **112**, 106403 (2014).
It is well known that, generically, one-dimensional interacting fermions cannot be described in terms of a Fermi liquid. Instead, they present a different phenomenology, that of a Tomonaga-Luttinger liquid: the Landau quasiparticles are ill defined, and the fermion occupation number is continuous at the Fermi energy. We demonstrate that suitable fine tuning of the interaction between fermions can stabilize a peculiar state of one-dimensional matter, which is dissimilar to both Tomonaga-Luttinger and Fermi liquids. We propose to call this state a quasi-Fermi liquid. Technically speaking, such a liquid exists only when the fermion interaction is irrelevant (in the renormalization group sense). The quasi-Fermi liquid exhibits the properties of both a Tomonaga-Luttinger liquid and a Fermi liquid. Similar to a Tomonaga-Luttinger liquid, no finite-momentum quasiparticles are supported by the quasi-Fermi liquid; on the other hand, its fermion occupation number demonstrates a finite discontinuity at the Fermi energy, which is a hallmark feature of a Fermi liquid. A possible realization of the quasi-Fermi liquid with the help of cold atoms in an optical trap is discussed.

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[3] *Bahrami M., Paternostro M., Bassi A., and Ulbricht H.*
Proposal for a noninterferometric test of collapse models in optomechanical systems.
Phys. Rev. Lett. **112**, 210404 (2014).
The test of modifications to quantum mechanics aimed at identifying the fundamental reasons behind the unobservability of quantum mechanical superpositions at the macroscale is a crucial goal of modern quantum mechanics. Within the context of collapse models, current proposals based on interferometric techniques for their falsification are far from the experimental state of the art. Here we discuss an alternative approach to the testing of quantum collapse models that, by bypassing the need for the preparation of quantum superposition states might help us addressing nonlinear stochastic mechanisms such as the one at the basis of the continuous spontaneous localization model.

[4] *Higginbotham A.P., Kuemmeth F., Larsen T.W., Fitzpatrick M., Yao J., Yan H., Lieber C.M., and Marcus C.M.*
Antilocalization of Coulomb blockade in a Ge/Si nanowire.
Phys. Rev. Lett. **112**, 216806 (2014).
The distribution of Coulomb blockade peak heights as a function of magnetic field is investigated experimentally in a Ge/Si nanowire quantum dot. Strong spin-orbit coupling in this hole-gas system leads to antilocalization of Coulomb blockade peaks, consistent with theory. In particular, the peak height distribution has its maximum away from zero at zero magnetic field, with an average that decreases with increasing field. Magnetoconductance in the open-wire regime places a bound on the spin-orbit length ($l_{so} < 20$ nm), consistent with values extracted in the Coulomb blockade regime ($l_{so} < 25$ nm).

[5] *Nakhmedov E. and Alekperov O.*
Zero-energy Majorana states in a one-dimensional quantum wire with charge-density-wave instability.
Phys. Rev. B **89**, 195445 (2014).
A one-dimensional lattice with strong spin-orbit interactions (SOIs) and a Zeeman magnetic field is shown to lead to the formation of a helical charge-density-wave (CDW) state near half filling. The interplay between the magnetic field, SOI constants, and the CDW gap seems to support Majorana bound states under appropriate values of the external parameters. An explicit calculation of the quasiparticles' wave functions supports the formation of a localized zero-energy state, bounded to the sample end points. Symmetry classification of the system is provided. The relative value of the density of states shows a precise zero-energy peak at the center of the band in the nontrivial topological regime.

[6] *Küfner S. and Bechstedt F.*
Topological transition and edge states in HgTe quantum wells from first principles.
Phys. Rev. B **89**, 195312 (2014).
$(HgTe)_N(CdTe)_M$ (110) and (001) superlattices are studied by means of ab initio calculations versus the thickness of the HgTe quantum wells (QWs). The used approximate quasiparticle theory including spin-orbit coupling (SOC) gives the correct band ordering, band gap, and SOC splitting for bulk HgTe and CdTe. The resulting band discontinuities indicate confinement also for occupied states. In agreement with earlier $k \cdot p$ calculations and experiments we find a topological transition from the topological nontrivial quantum spin Hall state into a trivial insulator with decreasing QW thickness. The spatial localization near the interfaces and the spin polarization are demonstrated for the edge states for QWs with thicknesses near the critical one. They do not depend on the QW orientation and are therefore topologically protected. Below the critical QW thickness, the trivial insulator exhibits drastic confinement effects with a significant gap opening. We show that the inclusion of inversion symmetry, the nonaxial rotation symmetry of the QWs, and the real QW barriers lead to some agreement but also significant deviations from the predictions within toy models. The deviations concern the critical thickness, the number and localization of edge states, and the possibility to find QW subbands between edge states.

[7] *Mahatha S.K., Moras P., Bellini V., Sheverdyaeva P.M., Struzzi C., Petaccia L., and Carbone C.*
Silicene on Ag(111): A honeycomb lattice without Dirac bands.
Phys. Rev. B **89**, 201416 (2014).
The discovery of (4×4) silicene formation on Ag(111) raised the question whether silicene maintains its Dirac fermion character, similar to graphene, on a supporting substrate. Previous photoemission studies indicated that the π band forms Dirac cones near the Fermi energy, while theoretical investigations found it shifted at deeper binding energy. By means of angle-resolved photoemission spectroscopy and density-functional theory calculations we show instead that the π-symmetry states lose their local character and the Dirac cone fades out. The formation of an interface state of free-electron-like Ag origin is found to account for spectral features that were theoretically and experimentally attributed to silicene bands of π character.

[8] *Prokudina M.G., Ludwig S., Pellegrini V., Sorba L., Biasiol G., and Khrapai V.S.*
Tunable nonequilibrium Luttinger liquid based on counterpropagating edge channels.
Phys. Rev. Lett. **112**, 216402 (2014).
We investigate the energy transfer between counterpropagating quantum Hall edge channels (ECs) in a two-dimensional electron system at a filling factor of $\nu = 1$. The ECs are separated by a thin impenetrable potential barrier and Coulomb coupled, thereby constituting a quasi-one-dimensional analogue of a spinless Luttinger liquid (LL). We drive one, say hot, EC far from thermal equilibrium and measure the energy transfer rate P into the second, cold, EC using a quantum point contact as a bolometer. The dependence of P on the drive bias indicates a breakdown of the momentum conservation, whereas P is almost independent of the length of the region where the ECs interact. Interpreting our results in terms of plasmons (collective density excitations), we find that the energy transfer between the ECs occurs via plasmon backscattering at the boundaries of the LL. The backscattering probability is determined by the LL interaction parameter and can be tuned by changing the width of the electrostatic potential barrier between the ECs.

[9] *Schneider M. and Brouwer P.W.*
Density of states as a probe of electrostatic confinement in graphene.
Phys. Rev. B **89**, 205437 (2014).
We theoretically analyze the possibility to confine electrons in single-layer graphene with the help of metallic gates, via the evaluation of the density of states of such a gate-defined quantum dot in the presence of a ring-shaped metallic contact. The possibility to electrostatically confine electrons in a gate-defined "quantum dot" with finite-carrier density, surrounded by an undoped graphene sheet, strongly depends on the integrability of the electron dynamics in the quantum dot. With the present calculations, we can quantitatively compare confinement in dots with integrable and chaotic dynamics, and verify the prediction that the Berry phase associated with the pseudospin leads to partial confinement in situations where no confinement is expected according to the arguments relying on the classical dynamics only.