[1] *Lunde A.M. and Platero G.*
Helical edge states coupled to a spin bath: Current-induced magnetization.
Physical Review B **86**, 035112 (July 2012).
We study current carrying helical edge states in a two-dimensional topological insulator coupled to an environment of localized spins, i.e., a spin bath. The localized spins mediate elastic spin-flip scattering between the helical edge states, and we show how this induces a spin-bath magnetization for a finite current through the edge states. The magnetization appears near the boundaries of the topological insulator, while the bulk remains unmagnetized, and it reaches its maximal value in the high bias regime. Furthermore, the helical edge states remain ballistic in steady state, if no additional spin-flip mechanisms for the localized spins are present. However, we demonstrate that if such mechanisms are allowed, then these will induce a finite current decrease from the ballistic value.

[2] *Sau J.D. and Das Sarma S.*
Realizing a robust practical Majorana chain in a quantum-dot-superconductor linear array.
Nature Communications **3**, 964 (July 2012).
Semiconducting nanowires in proximity to superconductors are promising experimental systems for realizing the elusive Majorana fermions, which, because of their non-Abelian anyonic braiding statistics, may ultimately be used as building blocks for topological quantum computers. A serious challenge in the experimental realization of the Majorana fermions is the suppression of topological superconductivity by disorder together with the tunability of carrier density for semiconductors in close proximity to superconductors. Here we show that Majorana fermions that are protected by a disorder robust topological gap can occur at the ends of a chain of gate-tunable quantum dots connected by s-wave superconductors. Such an array of quantum dots provides the simplest realization of Majorana fermions in systems as simple as a few quantum dot array. The proposed system provides a very practical and easily realizable experimental platform for the observation of non-Abelian Majorana modes.

[3] *Pereira R.G.*
Long time correlations of nonlinear Luttinger liquids.
arXiv:1207.3548v2 [cond-mat.str-el] (July 2012).
An overview is given of the limitations of Luttinger liquid theory in describing the real time equilibrium dynamics of critical one-dimensional systems with nonlinear dispersion relation. After exposing the singularities of perturbation theory in band curvature effects that break the Lorentz invariance of the Tomonaga-Luttinger model, the origin of high frequency oscillations in the long time behaviour of correlation functions is discussed. The notion that correlations decay exponentially at finite temperature is challenged by the effects of diffusion in the density-density correlation due to umklapp scattering in lattice models.

[4] *Becker D., Weiss S., Thorwart M., and Pfannkuche D.*
Non-equilibrium quantum dynamics of the magnetic Anderson model.
New Journal of Physics **14**, 073049 (July 2012).
We study the non-equilibrium dynamics of a spinful single-orbital quantum dot with an incorporated quantum mechanical spin-1/2 magnetic impurity. Due to the spin degeneracy, double occupancy is allowed, and Coulomb interaction together with the exchange coupling of the magnetic impurity influence the dynamics. By extending the iterative summation of real-time path integrals (ISPI) to this coupled system, we monitor the time-dependent non-equilibrium current and the impurity spin polarization to determine features of the time-dependent non-equilibrium dynamics. We particulary focus on the deep quantum regime, where all time and energy scales are of the same order of magnitude and no small parameter is available. We observe a significant influence of the non-equilibrium decay of the impurity spin polarization both in the presence and in the absence of Coulomb interaction. The exponential relaxation is faster for larger bias voltages, electron–impurity interactions and temperatures. We show that the exact relaxation rate deviates from the corresponding perturbative result. In addition, we study in detail the impurity's back action on the charge current and find a reduction of the stationary current for increasing coupling to the impurity. Moreover, our approach allows us to systematically distinguish mean-field Coulomb and impurity effects from the influence of quantum fluctuations and flip-flop scattering, respectively. In fact, we find a local maximum of the current for a finite Coulomb interaction due to the presence of the impurity.

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[5] *Endres M., Fukuhara T., Pekker D., Cheneau M., Schauss P., Gross C., Demler E., Kuhr S., and Bloch I.*
The 'Higgs' amplitude mode at the two-dimensional superfluid/Mott insulator transition.
Nature **487**, 454 (July 2012).
Spontaneous symmetry breaking plays a key role in our understanding of nature. In relativistic quantum field theory, a broken continuous symmetry leads to the emergence of two types of fundamental excitation: massless Nambu-Goldstone modes and a massive 'Higgs' amplitude mode. An excitation of Higgs type is of crucial importance in the standard model of elementary particle physics, and also appears as a fundamental collective mode in quantum many-body systems. Whether such a mode exists in low-dimensional systems as a resonance-like feature, or whether it becomes overdamped through coupling to Nambu-Goldstone modes, has been a subject of debate. Here we experimentally find and study a Higgs mode in a two-dimensional neutral superfluid close to a quantum phase transition to a Mott insulating phase. We unambiguously identify the mode by observing the expected reduction in frequency of the onset of spectral response when approaching the transition point. In this regime, our system is described by an effective relativistic field theory with a two-component quantum field, which constitutes a minimal model for spontaneous breaking of a continuous symmetry. Additionally, all microscopic parameters of our system are known from first principles and the resolution of our measurement allows us to detect excited states of the many-body system at the level of individual quasiparticles. This allows for an in-depth study of Higgs excitations that also addresses the consequences of the reduced dimensionality and confinement of the system. Our work constitutes a step towards exploring emergent relativistic models with ultracold atomic gases.

[6] *Dave K.B., Phillips P.W., and Kane C.L.*
Absence of Luttinger's theorem.
arXiv:1207.4201v1 [cond-mat.str-el] (July 2012).
We show exactly with an $SU(N)$ interacting model that even if the ambiguity associated with the placement of the chemical potential, μ, for a $T = 0$ gapped system is removed by using the unique value $\mu(T \to 0)$, Luttinger's sum rule is violated. The failure stems from the non-existence of the Luttinger-Ward functional for a system in which the self-energy diverges. Since it is the existence of the Luttinger-Ward functional that is the basis for Luttinger's theorem which relates the charge density to sign changes of the single-particle Green function, no such theorem exists. Experimental data on the cuprates are presented which show a systematic deviation from the Luttinger count, implying a breakdown of the elemental particle picture in strongly correlated electron matter.

[7] *Sanchis-Ojeda R., Fabrycky D.C., Winn J.N., Barclay T., Clarke B.D., Ford E.B., Fortney J.J., Geary J.C., Holman M.J., Howard A.W., Jenkins J.M., Koch D., Lissauer J.J., Marcy G.W., Mullally F., Ragozzine D., Seader S.E., Still M., and Thompson S.E.*
Alignment of the stellar spin with the orbits of a three-planet system.
Nature **487**, 449–453 (July 2012).
The Sun's equator and the planets' orbital planes are nearly aligned, which is presumably a consequence of their formation from a single spinning gaseous disk. For exoplanetary systems this well-aligned configuration is not guaranteed: dynamical interactions may tilt planetary orbits, or stars may be misaligned with the protoplanetary disk through chaotic accretion, magnetic interactions or torques from neighbouring stars. Indeed, isolated 'hot Jupiters' are often misaligned and even orbiting retrograde. Here we report an analysis of transits of planets over starspots on the Sun-like star Kepler-30, and show that the orbits of its three planets are aligned with the stellar equator. Furthermore, the orbits are aligned with one another to within a few degrees. This configuration is similar to that of our Solar System, and contrasts with the isolated hot Jupiters. The orderly alignment seen in the Kepler-30 system suggests that high obliquities are confined to systems that experienced disruptive dynamical interactions. Should this be corroborated by observations of other coplanar multi-planet systems, then star–disk misalignments would be ruled out as the explanation for the high obliquities of hot Jupiters, and dynamical interactions would be implicated as the origin of hot Jupiters.