1. **Observation of the Adler-Bell-Jackiw chiral anomaly in a Weyl semimetal**
   Chenglong Zhang et al.
   arXiv:1503.02630

   Here, for the first time, we report experimental studies of the first Weyl semimetal TaAs which reveals the chiral anomaly in its magnetotransport. Unlike most metals that become more insulating or resistive under an external magnetic field, we observe that our high mobility TaAs samples, quite remarkably, become more conductive as a magnetic field is applied along the direction of the current for certain ranges of the field and its magnetoconductance disperses quadratically which is nearly independent of temperatures below 20 K, but depends strongly on the relative angles between the electric and magnetic fields.

2. **Zero-energy Andreev bound states in a HgTe-based topological Josephson junction**
   J. Wiedenmann, E. Bocquillon, R. S. Deacon, S. Hartinger, T. M. Klapwijk, L. Maier, C. Ames, C. Brune, K. Ishibashi, S. Tarucha, H. Buhmann, L. W. Molenkamp
   arXiv:1503.05591

   In the surface states of a three-dimensional topological insulator, transport is mediated by Dirac-like fermions which exhibit a helical spin polarization. When coupled to superconductors in a Josephson junction, topologically protected zero-energy Andreev bound states are predicted, whose energy varies 4π-periodically with the superconducting phase difference. This results in a fractional 4π-periodic Josephson current. In HgTe-based topological junctions, we observe a 4π-periodic supercurrent as a response to an external rf excitation. Further observations also support the presence of zero-energy states in our HgTe-based junctions.

3. **Gapless Topological Superconductors - Model Hamiltonian and Realization**
   Y. Baum, T. Posske, I.C. Fulga, B.Trauzettel, and A.Stern
   arXiv:1503.04845

   The existence of an excitation gap in the bulk spectrum is one of the most prominent fingerprints of topological phases of matter. In this paper, we propose a family of two dimensional Hamiltonians that yield an unusual class D topological superconductor with a gapless bulk spectrum but well-localized Majorana edge states. We perform a numerical analysis for a representative model of this phase and suggest a concrete physical realization by analyzing the effect of magnetic impurities on the surface of strong topological insulators.

4. **Topological Acoustics**
   Zhaoju Yang et al.
   PRL 114, 114301 (2015)

   The manipulation of acoustic wave propagation in fluids has numerous applications, including some in everyday life. Acoustic technologies frequently develop in tandem with optics, using shared concepts such as waveguiding and metamedia. It is thus noteworthy that an entirely novel class of electromagnetic waves, known as topological edge states, has recently been demonstrated. These are inspired by the electronic edge states occurring in topological insulators, and possess a striking and technologically promising property: the ability to travel in a single direction along a surface without backscattering, regardless of the existence of defects or disorder. Here, we develop an analogous theory of topological fluid acoustics, and propose a scheme for realizing topological edge states in an acoustic structure containing circulating fluids. The phenomenon of disorder-free one-way sound propagation, which does not occur in ordinary acoustic devices, may have novel applications for acoustic isolators, modulators, and transducers.

5. **Disorder sets light straight**
   Jorge Bravo-Abad
   Nature, 11, 2015

   Photonic crystals can control the flow of light but they are extremely sensitive to structural disorder. Although this often degrades performance, disorder can actually be used to enhance light collimation.

6. **Recovering of superconductivity in S/F bilayers under spin-dependent nonequilibrium quasiparticle distribution**
   I.V.Bobkova, A.M.Bobkov
   Pisma v ZhETF 101, 442 (2015)

   We study theoretically the influence of spin accumulation on superconductivity in a superconductor/ferromagnet bilayer. It is well-known that the superconductivity in Superconductor/Ferromagnet (S/F) bilayers is suppressed by the proximity to a ferromagnet. The spin accumulation by itself is also a depairing factor. But here we show that creation of the spin accumulation on top of effective exchange depairing, caused by the proximity to a

ferromagnet, can lead to an opposite result. The superconductivity can be partially recovered by spin-dependent quasiparticle distribution. The systems with realistic parameters are considered and the possible experimental setup is proposed.

7. **Boltzmann-Langevin theory of Coulomb drag**
   W. Chen, A. V. Andreev, and A. Levchenko
   arXiv:1503.05566

   We develop a Boltzmann-Langevin description of Coulomb drag effect in clean double-layer systems with large interlayer separation d as compared to the average interelectron distance. Coulomb drag arises from density fluctuations with spatial scales of order d. At low temperatures their characteristic frequencies exceed the intralayer equilibration rate of the electron liquid, and Coulomb drag may be treated in the collisionless approximation. As temperature is raised the electron mean free path becomes short due to electron-electron scattering. This leads to local equilibration of electron liquid and consequently drag is determined by hydrodynamic density modes. Our theory applies to both collisionless and hydrodynamic regime and enables us to describe the crossover between them. We find that drag resistivity exhibits nonmonotonic temperature dependence with multiple crossovers at distinct energy scales. At lowest temperatures Coulomb drag is dominated by the particle-hole continuum, whereas at higher-temperatures of the collision-dominated regime it is governed by the plasmon modes. We observe that fast intralayer equilibration mediated by electron-electron collisions ultimately renders stronger drag effect.

8. **Hidden spin polarization in inversion-symmetric bulk crystals**
   Chien-Te Wu, Brandon M. Anderson, Rufus Boyack and K. Levin
   arXiv:1503.05454

   We derive expressions for spin and density correlation functions in the (greatly enhanced) pseudogap phase of spin-orbit coupled Fermi superfluids. Density-density correlation functions are found to be relatively insensitive to the presence of these Rashba effects. To arrive at spin-spin correlation functions we derive new f-sum rules, valid even in the absence of a spin conservation law. Our spin-spin correlation functions are shown to be fully consistent with these f-sum rules. Importantly, they provide a clear signature of the Rashba band-structure and separately help to establish the presence of a pseudogap.

9. **Excitonic Josephson effect in double-layer graphene junctions**
   B. Zenker, H. Fehske, and H. Beck
   arXiv:1503.06008

   We show that double-layer graphene (DLG), where an external potential induces an charge- imbalance between n- and p-type layers, is a promising candidate to realize an exciton condensate in equilibrium. To prove this phenomenon experimentally, we suggest to couple two DLG systems, separated by a thin insulating barrier, and measure the excitonic Josephson effect. For this purpose we calculate the ac and dc Josephson currents induced by tunneling excitons and show that the former only occurs when the gate potentials of the DLG systems differ, irrespective of the phase relationship of their excitonic order parameters. A dc Josephson current develops if a finite order-parameter phase difference exists between two coupled DLG systems with identical gate potentials.

10. **A new type of Weyl semimetal with quadratic double Weyl fermions in SrSi2**
    Shin-Ming Huang, Su-Yang Xu, Ilya Belopolski, Chi-Cheng Lee, Guoqing Chang, BaoKai Wang, Nasser Alidoust, Madhab Neupane, Hao Zheng, Daniel Sanchez, Arun Bansil, Guang Bian, Hsin Lin, and M. Zahid Hasan
    arXiv:1503.05868

    Relativistic fermions can be of three important varieties: Dirac, Majorana and Weyl. Recently, the Weyl semimetals, whose low-lying excitations are Weyl Fermions, have attracted worldwide attention due to their wide range of exotic electro-magnetic properties expected in theory. The experimental realization had remained elusive for a long time despite much efforts. Very recently, photoemission experiments (ARPES) have shown strong evidence identifying the first Weyl semimetal state in stoichiometric solid TaAs which marks the beginning of experimental research activity on this fascinating topic. In this paper, we propose such a Weyl semimetal state in an inversion breaking, stoichiometric compound strontium silicide, SrSi2, with many new and novel properties that are distinct from the TaAs family even in theoretical concepts. We theoretically show that SrSi2 is a Weyl semimetal even without spin-orbit coupling and that, after the inclusion of spin-orbit coupling, two Weyl fermions stick together forming an exotic double Weyl fermion with quadratic dispersions and a higher chiral topological charge of 2. Moreover, we find that the Weyl nodes with opposite charges are located at different energies due to the absence of mirror symmetry in SrSi2, leading to a unique topological quantum response that an external magnetic field can induce a dissipationless current.