

ELECTRON-ELECTRON IN GRAPHENE AND OTHER NEW 2D MATERIALS WORKSHOP SUMMARY

The discovery of graphene launched a very exciting field which continues to bring new surprising phenomena. Recent progresses made in graphene and other novel 2D material systems start to reveal interesting emergent physics where electron-electron interactions play a key role. The William I. Fine Theoretical Physics Institute (FTPI) at the University of Minnesota sponsored and hosted a workshop “Low-Dimensional Quantum Gases out of Equilibrium” from May 3 to 5, 2013. The goal of this workshop was to bring together the leading experts and young researchers to facilitate the exchange of ideas and information in this rapidly evolving and extremely active area of research. The workshop was organized by Philip Kim (Columbia), Boris Shklovskii (FTPI), and Michael Zudov (Minnesota). A total of 18 talks were presented covering almost equally both theoretical and experimental developments. The participation of young researchers (graduate students and postdocs) was especially encouraged, who attended a number of plenary talks and presented posters during coffee breaks and social hours.

The workshop started with an excellent talk by 2010 Nobel Prize winner Andre Geim (Manchester) which focused on hetero-structures assembled from individual atomic planes, followed by presentations by Pablo Jarillo-Herrero (MIT) on quantum transport in graphene/hBN heterostructures and by Francisco Guinea (Autónoma de Madrid) on interaction effects in graphene near the neutrality point. The afternoon section featured talks by Eva Andrei (Rutgers) on screening charge impurities in graphene, by Allan MacDonald (Texas) on broken SU(4) symmetry and the fractional quantum Hall effect, by Chun Ning Lau (UC Riverside) on transport studies of correlated phenomena in few layer graphene, and by Sankar Das Sarma (Maryland) on graphene as an interacting Fermi liquid.

The next day of the workshop started with talks by Philip Kim (Columbia), who reported observation of Hofstadter's butterfly, and by Vladimir Falko (Lancaster), who discussed generations of Dirac electrons due to moiré super-lattice. After the coffee break, Brian Skinner (Minnesota) presented his theoretical study of large capacitance enhancement due to electron correlations and Tony Heinz (Columbia) spoke on probing of electron-electron interactions in graphene and MoS₂ by optical spectroscopy. In the afternoon, Leonid Levitov (MIT) spoke on electron interactions and collective energy transport and Alberto Morpurgo (Geneva) discussed interaction effects in suspended graphene devices. The workshop day was closed by an excellent talk by Amir Yacoby (Harvard) who spoke on local electron compressibility measurements of FQHE. Particular exciting was his discovery of missing FQHE states and new phase transitions between differently spin polarized states.

In the morning of the last day of the workshop, Marek Potemski (Grenoble) reported on electron-phonon coupling and electronic excitations probed by magneto-Raman scattering and Michael Fogler (UC San Diego) discussed intrinsic plasmon damping in graphene. After the coffee break, Leonid Ponomarenko (Manchester) and Igor Gornyi (Karlsruhe) presented their results on coulomb drag in graphene double layers.

During the workshop, many participants expressed their excitement with the level of science of the workshop and their appreciation for the opportunity to participate. Ideas and collaborations initiated during the workshop will certainly propel the field in years to come. In summary, this was a very productive and strongly interactive workshop.

Summary by Boris Shklovskii

Workshop website: <http://www.ftpi.umn.edu/workshops/2012-2013/eig2013/index.html>