**Physics Colloquium:**

**Title:** “S-TI-S (Superconductor-Topological Insulator-Superconductor) Josephson junction networks: a platform for exploring and exploiting Majorana fermions for Quantum Information Science and Technology"

**Speaker:** Dale J. Van Harlingen, UIUC

**Wednesday, August 29 at 4:00 pm in 141 Loomis**

Abstract: One of the proposed approaches to realize a quantum computer is to make use of exotic Majorana fermion modes that can exist in hybrid systems which intertwine superconductivity and topological order. The goal is to take advantage of the delocalization of quantum information and the non-Abelian statistics of the Majorana states to avoid dephasing and minimize error corrections in what is known as topologically-protected quantum computing. In this talk, I will describe a potential platform for nucleating and manipulating Majorana fermions in multiply-connected networks of lateral Josephson junctions fabricated by depositing superconductor electrodes onto the surface of topological insulators. In a magnetic field, Majorana fermions are localized in the cores of Josephson vortices at locations in the junction where the phase difference is an odd multiple of π, and they can be moved by applying fields, currents, and voltages to perform quantum operations. Electronic transport measurements on Nb-Bi₂Se₃-Nb devices exhibit anomalous features consistent with a 4π-periodic sin(φ/2)-component in the Josephson current-phase relation consistent with this picture. We are now exploring circuits for imaging, manipulating, and braiding these exotic excitations and developing schemes for reading out the parity of the Majorana pairs that encodes the quantum information.
**CALENDAR OF EVENTS** [http://physics.illinois.edu/bluesheet.asp](http://physics.illinois.edu/bluesheet.asp)

**Monday, August 27:** Instruction Begins for Fall 18

**Monday, August 27:** ME/HE Seminar; "Evidence for a source of high energy astrophysical neutrinos" Justin Vanderbroucke, U. of Wisconsin; in Loomis 464 at 1:00 pm

**Wednesday, August 29:** Physics Colloquium; “S-TI-S (Superconductor-Topological Insulator-Superconductor) Josephson junction networks: a platform for exploring and exploiting Majorana fermions for Quantum Information Science and Technology” Dale J. van Harlingen, U. of Illinois Urbana Champaign, in 141 Loomis Lab at 4:00 pm

**Friday, August 31:** Condensed Matter Seminar; "Quantum gas microscopy of strongly interacting fermions in optical lattices.” Waseem Bakr, Princeton University; In 190 ESB at 1:00

**Saturday, September 1:** Science at the Market: Astrollini; 8:00 am to Noon at Lincoln Square Mall’s Market at the Square

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**Topological Phases in Condensed Matter and Ultracold Atoms Systems**

October 02 - 12, 2018

The 2016 Nobel Prize in Physics was awarded to pioneering work opening the field of topological phases of matter. This field has matured later on in the study of the fractional quantum Hall effect, which continues to deliver exciting physics, in the form of non-abelian excitations and the observation of neutral edge modes. Inspired by the quantum Hall effect, the study of non-abelian particles has branched into different topics, such as the study of topological phases emerging in (spin) lattice models and recently topological insulators and superconductors. During recent years, the field of topological phases has been boosted by the possible application to quantum computing. Implementing topological quantum computation in realistic experimental systems is one of the holy grails of the community.

**Main topics will include**
- Topological phases & Quantum Simulations
- Strongly Correlated Electrons & Cold Atoms
- Machine Learning & Quantum Computation
- Non-equilibrium Physics

**Application and registration**
[https://www.azur-colloque.fr/DR14/inscription](https://www.azur-colloque.fr/DR14/inscription)
Contact and organization : Malika Bentour, topo2018@irsamc.ups-tlse.fr
Deadline Application : 31/08/2018
Registration Fees (includes lodging, lunches, breakfasts and coffee breaks) : 750 euros (free for invited speakers and CNRS PhD/post-docs)
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Condensed Matter Seminar:

Title "Quantum gas microscopy of strongly interacting fermions in optical lattices."

Speaker: Waseem Bakr, Princeton University

Friday, August 31, 2018 In 190 ESB

Ultracold fermions in optical lattices provide a clean physical realization of the celebrated Fermi-Hubbard model of condensed matter, a minimal model believed to contain the essential ingredients for high-temperature superconductivity. Recent advances in the field of quantum gas microscopy have opened up the possibility to probe and manipulate Fermi-Hubbard systems at the atomic level, enabling quantitative studies at temperatures that are challenging for state-of-the-art simulations on classical computers. In this talk I will report on experiments that probe equilibrium spin and density correlations in the Hubbard model in new regimes, including a repulsive spin-imbalanced system and a doped attractive system, which are related to each other through a mathematical mapping. I will also report on experiments where we measure the transport properties of doped repulsive systems. We find that the resistivity exhibits a linear temperature dependence and shows no evidence of saturation, two characteristic signatures of a bad metal.
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Visitors:

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Job Opportunity

The Department of Physics and Astronomy at the University of Utah invites applications for a tenure track faculty position in Theoretical Condensed Matter Physics. This search will be directed at the tenure track Assistant Professor level, but we will also consider more senior candidates under exceptional circumstances. The appointment will start in July 2019. The successful candidate must have an outstanding research record for his/her experience level and also show promise of teaching effectively at both the undergraduate and graduate levels. Information about the University of Utah and in particular the Department may be found at URL http://www.physics.utah.edu.

The deadline for receipt of application materials is December 1, 2018. However, applications may be considered after the deadline until the position is filled. Applications, including curriculum vitae, a statement of research interests and plans, a statement of teaching philosophy, and at least three letters of recommendation, should be submitted using this link:


The University of Utah values candidates who have experience working in settings with students from diverse backgrounds, and possess a strong commitment to improving access to higher education for historically underrepresented students.
Visitors:

The 2018 Bardeen Prize is awarded to Andrey V. Chubukov, Igor Mazin, and Sebastian Doniach "For sustained theoretical contributions to the field of unconventional and multi-orbital superconductivity and superconducting quantum fluctuations”.

Andrey V. Chubukov:
For seminal contributions to the theory of unconventional superconductivity, including applications to the iron-based superconductors.

Igor Mazin:
For influential first-principles theoretical approaches to a broad class of multi-orbital superconductors, such as MgB2 and the iron-based compounds.

Sebastian Doniach:
For pioneering work on Josephson junction coupled arrays and layered superconductors, quantum fluctuations in superconductors, and the possibility of a superconductor-insulator transition.

The 2018 Bardeen Prize Committee:
Susan Coppersmith Eduardo Fradkin (chair), Aharon Kapitulnik, Subir Sachdev, Jörg Schmalian, Haihu Wen.
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Science at the Market:

Astrolllini

Saturday, September 2, 8:00 Am – 12:00 Pm

Urbana Market at Square, Lincoln Square Urbana, IL

For the 9th year, the U of I is bringing "Science at the Market" on most Saturday mornings to the Farmers Market at Lincoln Square mall in Urbana.

The U of I and other experts will be on hand with demonstrations illustrating the science they represent, and to answer questions from the public about the researchers' discipline.