Welcome to Spring 2021: to get Zoom meeting details for seminars please email jbenner@illinois.edu or bullwink@illinois.edu

Tuesday, February 9: Condensed Matter Journal Club: "Modeling the Optical Absorption and Luminescence Spectra of NV- Centers in Diamond from First Principles", Kevin Kleiner, UIUC 4:00 pm via Zoom

Wednesday, February 10: Physics Colloquium: “Quantum Science with Alkaline Earth Atom Arrays”, Jake Covey, UIUC, 4:00 pm - via Zoom

Thursday, February 11: Math Physics Seminar: “Classical Aspects of Black Hole Interiors” Jorrit Kruthoff, Stanford, 1:00 Pm via Zoom

Friday, February 12: Condensed Matter Seminar: “Lattice-like models for protected edges with no symmetry” Sriram Ganeshan, CUNY, 1:00 pm via Zoom

Welcome to the Institute for Condensed Matter Theory

Due to the COVID-19 outbreak most Physics staff are now working remotely.

If you need to contact Janice Benner please email her at jbenner@illinois.edu or call her at 217-244-4268

If you need to contact Stephen Bullwinkel please email him at bullwink@illinois.edu.

We will get back to you as soon as we can.
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Condensed Matter Journal Club

**Title:** "Modeling the Optical Absorption and Luminescence Spectra of NV- Centers in Diamond from First Principles"

**Speaker:** Kevin Kleiner

**Date:** February 9, 2021  
**Time:** 4:00 pm  
**Location:** Zoom

**Abstract:** Nitrogen-vacancy (NV-) centers in diamond host well-isolated, controllable spin states, making them prime candidate systems for room temperature quantum information. Optical transitions play a critical role in reading out the spin states, but those processes are strongly influenced by the presence of defect vibrational modes, giving rise to a quasi-continuum of energy levels associated with each spin state. Thus, one major challenge is identifying individual vibrational modes that preferentially participate in optical absorption and luminescence. Solving this problem requires an intricate understanding of an NV- center’s electronic states, vibrational states, and electron-phonon coupling. I will describe how first-principles electronic structure calculations can accurately model the NV- center’s electrons and nuclei, while also reviewing some fundamental properties of crystal defect systems.

The Zoom link will be sent to the Graduate Student and PDRA mailing lists. If you are not on one of those lists and are interested in attending, please email Mark Hirsbrunner at hrsbrnn2@illinois.edu for the link.
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**Title:** “Quantum Science With Alkaline Earth Atom Arrays”

**Speaker:** Jake Covey, University of Illinois

**Date:** February 10, 2021  **Time:** 4:00 pm  via Zoom

**Abstract:** Cold atomic gases have long been a prominent platform for quantum science applications ranging from many-body physics to precise timekeeping. In recent years, techniques have been developed to control and detect individual atoms in arrays of up to several hundred using optical microtraps called "tweezers". This control has allowed the community to tame an unwieldy class of atomic states that holds the key to robust entanglement: the highly-excited Rydberg states. These breakthroughs are poised to revolutionize quantum science with neutral atoms. I will summarize the emergence of the "Rydberg atom array" platform and provide an overview of our vision to take this platform in new directions using alkaline earth atoms.

The ZOOM link will be sent on Wednesday morning to the Physics Faculty, Graduate Student, PDRA, and AP mailing lists. If you are not on one of those lists and are interested in attending, please email Suzanne Hallihan at shalliha@illinois.edu for the link.
Title: "Classical aspects of black hole interiors"

Speaker: Jorrit Kruthoff (Stanford)

Date: February 11, 2021  Time: 1:00 pm  via Zoom

Abstract: We will discuss the geometry behind the horizon of various asymptotically AdS black holes when the boundary CFT is deformed by a scalar operator. The dynamics of classical GR in the region inside the black hole turns out to be rather intricate, with even fractal like behavior emerging in some situations. We will see that, generically, in the presence of a scalar deformation, Cauchy horizons are replaced by a spacelike singularity. This motivates a notion of 'holographic' cosmic censorship. This talk is based on 2004.01192, 2006.10056 and 2008.12786.
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Title: "Lattice-like models for protected edges with no symmetry."

Speaker: Sriram Ganeshan, The City University of New York,

Date: February 12, 2021  Time: 1:00 pm  via Zoom

Abstract: In this talk, I will outline our recent work on constructing “lattice” models with finite dimensional onsite Hilbert space for the edge of Fractional Quantum Hall states with of zero central charge ($n_L-n_R=0$) described by a $2 \times 2$ K-matrix $K = \begin{pmatrix} k_1 & 0 \\ 0 & -k_2 \end{pmatrix}$. Our lattice models contains both gapable and ungapable protected edges depending on the values of $k_{1,2}$. We derive our lattice models by strongly coupling the edge modes modeled by counter-propagating Luttinger liquids to an array of domain walls formed by alternating superconducting and ferromagnetic impurities. Contrary to the lattice constructions for SPT edges, the Hilbert space associated with our “lattice” models cannot be written as a local tensor product structure.

Recordings of Condensed Matter Seminar events can be found on mediaspace: https://mediaspace.illinois.edu/channel/Condensed%2BMatter%2BSeminar%2BTalks%2BFall%2B2020/178724052