

**CALENDAR OF EVENTS** <http://physics.illinois.edu/bluesheet.asp>

**Monday, September 18, ICMT Seminar:** "Topological phase transitions in multi-component superconductors" Yuxuan Wang; University of Illinois, 12:00 pm in 190 ESB

**Monday, September 18, ME/HE Seminar:** "Development of LArTPC for Neutrino Physics"; Xin Qian, Brookhaven National Laboratory, 1:00 pm in 276 Loomis

**Tuesday, September 19, Astronomy Colloquium:** "the IllustrisTNG Simulations: Elemental Evolution in Cosmological Simulations" Jill Naiman, Harvard-Smithsonian Center for Astrophysics, 12:00 pm 134 Astronomy

**Wednesday, September 20, Astrophysics, Gravitation and Cosmology Seminar:** "Mapping the Cosmos with the Dark Energy Survey" Chihway Chang, University Of Chicago, 12:00 pm in 276 Loomis

**Wednesday, September 20, Physics Colloquium:** "Virus Interactions Inside the Cell: Competition or Cooperation?" Lanying Zeng, Texas A&M University, 4:00 pm in 141 Loomis

**Visitor:** · Marian Berek, University of Waterloo, Canada, (Leggett), ESB 3129, August-December 2017  
· Jose Castano Verde, Universidad de Santiago de Compostela, (Leggett), ESB 3129, September 6-December 2, 2017

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**Closing date: Saturday, 30 September 2017**

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# ICMT Seminar

**Title:** "Topological phase transitions in multi-component superconductors"

**Speaker:** Yuxuan Wang, University of Illinois Urbana Champaign

**Date:** Monday, September 18      **Time/Location:** 12:00 pm / 190 ESB

**Abstract:** We study the phase transition between a trivial and a time-reversal-invariant topological superconductor. By analyzing the interplay of symmetry, topology and energetics, we show that for a generic normal state band structure, the phase transition occurs via extended intermediate phases in which even- and odd-parity pairing components coexist. For inversion symmetric systems, the coexistence phase spontaneously breaks time-reversal symmetry. For noncentrosymmetric superconductors, the low-temperature intermediate phase is time-reversal breaking, while the high-temperature phase preserves time-reversal symmetry and has topologically protected line nodes. Furthermore, with approximate rotational invariance, the system has an emergent  $U(1) \times U(1)$  symmetry, and novel topological defects, such as half vortices binding Majorana fermions, can exist. Relevance of our theory to superconducting pyrochlore oxide  $Cd_2Re_2O_7$  and half-Heusler materials is discussed.

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# ME/HE Seminar

**Title:** "Development of LA/TPC for neutrino physics"

**Speaker:** Xin Wian, Brookhaven National Laboratory

**Date:** Monday, September 18      **Time/Location:** 1:00 pm / 276 Loomis

**Abstract:** Liquid Argon Time Projection Chamber (LArTPC), with its mm-scale position resolution and the full-active-volume imaging-aided calorimetry, is an excellent device to detect accelerator neutrinos at GeV energy range. This technology may hold the key to search for new CP violation in the lepton sector, to determine the neutrino mass hierarchy, to precisely measure neutrino mixing parameters, to search for baryon number violation, and to search for sterile neutrino(s). In this talk, I will review the current status of the detector development. In particular, the challenges in TPC signal processing and event reconstruction will be discussed among other subjects.

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# Astronomy Colloquium

**Title:** "The IllustrisTNG Simulations: Elemental Evolution in Cosmological Simulations"

**Speaker:** Jill Naiman (Smithsonian Center for Astrophysics)

**Date:** Tuesday, September 19

**Time/Location:** 3:45 pm / 134 Astronomy

**Abstract:** I will give an overview of some of the new features of the IllustrisTNG models - a set of gravitational, hydrodynamical, MHD cosmological simulations aimed at resolving from the formation of galaxy clusters down to the structures of Milky Way dwarf galaxies. A brief overview of AREPO, the code used in these simulations, and updates from its first cosmological implementation in the Illustris simulations will be presented. I will conclude with some preliminary results on the distribution of elements in our simulations including alpha and r-process elements, and discuss ongoing efforts to robustly compare observational and simulated data.

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# Astrophysics, Gravitation and Cosmology Seminar

**Title:** “Mapping the Cosmos with the Dark Energy Survey”

**Speaker:** Chihway Chang (University of Chicago)

**Date:** Wednesday, September 20

**Time/Location:** 12:00 pm / 276 Loomis

**Abstract:** The first year data from the Dark Energy Survey (DES Y1) provides the most powerful optical survey dataset to date. In this talk I will first give an overall summary of the cosmology results from the DES Y1 dataset combining galaxy clustering and weak gravitational lensing. Next, I will describe our work in generating and testing the wide-field weak lensing mass maps from the galaxy shape measurements and some exciting applications for the maps. I will end with thoughts on how weak lensing could also inform us on various topics of galaxy formation, which is essential for completing the story behind the Universe we see today.

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**Title:** "Virus Interactions Inside the Cell: Competition or Cooperation?"

**Speaker:** Lanying Zeng (Texas A&M University)

**Date:** Wednesday, September 20

**Time/Location:** 4:00 pm / 141 Loomis

**Abstract:** Living cells make fate-determining decisions based on signals from their environment. Understanding the decision making process is essential for unveiling the mysteries of life and for improving human health. I will discuss our recent studies of a paradigmatic system of cell-fate determination, the bacterium *E. coli* and its virus – phage lambda, using a live-cell 4-color system combined with computational modeling at the single-virus/single-virus-DNA resolution. The textbook picture is: upon infection by phage lambda, *E. coli* undergoes one of two alternate pathways - lytic (virulent) or lysogenic (dormant). With the high-resolution studies, this paradigmatic system has been revealed to be more complicated than previously thought. Our studies suggest that individual phages vote and interact within the cell: they cooperate during lysogenization, compete among each other during lysis, and confusion or coexistence between the two pathways occasionally occurs. I will also discuss the sources/mechanisms for phages to make different decisions and utilize variable strategies for their development.