FALL 2019 Colloquium Series

Date: Thursday, November 21st, 2019

Speaker: Keat Ghee Ong, UO

Phil and Penny Knight Campus for Accelerating Scientific Impact

Title: Embedded Wireless Sensors

Abstract: Embedded wireless sensors are self-powered or passively powered sensors residing inside or around the object/area of interest for real-time, localized information gathering. Physical, chemical, and/or biological data collected from these sensors are usually wirelessly transmitted to a centralized system for further processing and interpretation. Embedded wireless sensors have many applications such as continuous structural monitoring, human health monitoring, pollution detection and home security, etc. Since different types of sensors can be incorporated into various objects and environments, embedded sensors are not limited to a single class of sensor or a specific measurement technique. The speaker has 20 years of experience in embedded sensors technologies, and has developed a number of them including the RFID sensors, the magnetoelastic sensors, and the battery-powered wireless Bluetooth sensors. Currently, his lab focuses on the implementation of these sensors for regenerative medicine and environmental monitoring.

This presentation will focus on the design and application of embedded wireless sensors for medical applications. Specifically, the application of magnetoelastic sensors, RFID sensors, and Bluetooth-based sensors to provide real-time monitoring of bones and blood vessels will be presented. The speaker will also describe the use of magnetoelastic sensors for detecting biomarkers and other chemical concentrations. Furthermore, the strengths and weaknesses of embedded sensors, as well as their future prospects and challenges, will be discussed.
Speaker **Tim Gardner, UO**

**Knight Campus for Accelerating Scientific Impact**

**Title: Tracking Neural Programs for Song**

Abstract: We seek to understand the neural circuit basis for memory stability in the songbird. This talk describes technical challenges to recording neural activity in singing birds, and engineering efforts to provide miniature devices for brain and nerve recording. We apply these tools to ask how the brain encodes a stable behavior – the stereotyped song of a zebra finch. We find a mesoscopic dynamical pattern that relates excitatory and inhibitory neurons, state dependent control of variability in neural firing patterns, and an unexpected turnover in the neural representation of a stable behavior that occurs during intervals of sleep. These observations can be loosely related to aspects of regularization in modern machine learning that reduce over-fitting of artificial neural networks.

Host Raghu Parthasarathy

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Date: Thursday, November 7, 2019

Speaker **Zoltan Ligeti, Lawrence Berkeley National Laboratory**

**Title: Flavor Physics: Past, Present, Future**

Abstract: Despite its spectacular successes, the standard model of particle physics does not contain a possible candidate for dark matter, nor can it explain the observed asymmetry between matter and antimatter in the Universe.

The interactions of the Higgs boson, which give quarks and leptons their masses, also lead to violation of the symmetry between matter and antimatter in electroweak interactions. This can explain the differences observed between matter and antimatter in laboratory experiments, but it is insufficient to explain the dominance of matter over antimatter in the Universe. Thus, additional interactions must exist, which differentiate between matter and antimatter. The Large Hadron Collider will test the properties of the Higgs boson with ever increasing precision. After a brief review of the standard model, I discuss some of the current constraints on extensions of the standard model, what we may learn in the next decade, and how this information could be combined with possible other discoveries to answer some deep questions.
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Date: Thursday, October 31, 2019

Speaker David Lucas, Clarendon Laboratory, Oxford

Title: Quantum logic with trapped ions: precise, fast, networked

Abstract: The concepts of quantum information processing date back at least 35 years, to the ideas of quantum simulation and computing suggested by Feynman and Deutsch. Experimental progress in the field often appears slow, partly because of the demanding precision required in the elementary logic operations for quantum error correction, partly because of the technical challenges associated with scaling systems up to larger numbers of qubits, and partly because our expectations are colored by the enormous power and progress of classical computing technology over the last hundred years.

I will give a brief survey of the state of the art across the various platforms which are being explored for quantum computing, and argue that
progress is in fact extremely encouraging. I will then report on recent work in Oxford on improving the precision and speed of quantum logic operations in the ion trap platform, and on building an elementary quantum network to distribute entanglement between two different ion trap "nodes" separated by a macroscopic distance.

Hosts: David Allcock and David Wineland

Date: Thursday, October 24, 2019

Speaker: Benjamín Alemán, University of Oregon

Title: The fall and rise of the mass on a spring

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Hosts: David Allcock and David Wineland

Date: Thursday, October 17th, 2019

Speaker: Andrew MacFadyen, NYU

Title: Gas dynamics and electromagnetic signatures of gravitational wave sources

Abstract: I will present numerical simulations of the gas dynamics and electromagnetic signatures of gravitational wave sources. I will discuss the merging neutron star system GW170817 and present evidence from the afterglow of GRB170817A that a successful highly beamed off-axis relativistic jet was produced. I will then discuss binary black hole accretion and show that binaries embedded in gas should remain electromagnetically active throughout the merging process.

Host: Ben Farr
Date: Thursday, October 10th, 2019

Speaker: **Timothy Cohen, University of Oregon**

Title: **Describing Nature Effectively**

Abstract The aim of this colloquium will be to provide some insight into a modern point of view on dimensional analysis known as Effective Field Theory. This approach systematically distills a physical problem to the essential degrees of freedom that are relevant for modeling the dynamics of interest. After discussing some intuitive examples, I will describe a situation where these techniques have recently been put to use by myself and collaborators: heavy dark matter annihilations relevant for indirect detection. I will expose an issue with the standard Feynman diagram perturbation theory that arises when attempting to predict the annihilation rate. I will then sketch how Effective Field Theory techniques can be used to restore our ability to calculate in a controlled way, allowing us to produce a precision prediction that is relevant for current and future experiments.

Date: Thursday, October 3rd, 2019

Speaker: **Richard Taylor, University of Oregon**

Title: **State of the Department**