Friday, Jan. 16, 2015 at 1:45pm Where: Cavalry Building (CGWA conference room)

Title: Promoting Diversity in Physics Graduate Education: APS Bridge Program

Presented by: Ted Hodapp, American Physical Society

In 2015 the American Physical Society will place enough students into supportive graduate programs to effectively /erase/ the disparity in underrepresented minority student participation in physics doctoral studies. Built on successful examples, and motivated by the Society's desire to improve physics education for all students, the APS Bridge Program matches motivated and capable students with resources to help them overcome issues that might otherwise deny them the chance to pursue a PhD in physics. The project's key features will be discussed as well as ways that Brownsville students and faculty can participate. In addition, APS will launch a National Mentoring Community this spring, aimed at increasing the number of underrepresented students who complete physics bachelor's degrees. Bring your questions and ideas to help improve physics education for everyone.

Wednesday, Feb 4, 2015 at 3:00pm Where: Cavalry Building (CGWA conference room)

Title: The Hubble constant in the era of precision cosmology

Presented by: Lucas Macri, Texas A & M

Having settled the decades-long bitter debate over the value of the Hubble constant, research on the Extragalactic Distance Scale has seen a remarkable transformation over the past few years. The focus is now on a proper accounting of all sources of systematic uncertainty and the development of new techniques to further increase the accuracy and precision in the measurement of H_0.

What is the motivation for further work on the Hubble constant? Measuring H_0 at the percent level will significantly improve the constraints on the equation of state of dark energy and other cosmological parameters from ongoing and planned surveys (such as DES, HETDEX, BigBOSS and LSST). The current uncertainty on H_0 is 3.5% and work is underway to reduce it to 2% by mid-2015. A 1% measurement should be achievable by the end of the decade based on Gaia parallaxes and observations with the James Webb Space Telescope.

I will review recent progress in the field, including near- and far-infrared observations of Galactic and extragalactic Cepheids, the absolute calibration of the luminosity of type Ia SNe, determinations using baryon acoustic oscillations and the cosmic microwave background, and results based on time-delay distances from strong lensing. I will discuss future prospects using HST, Gaia and JWST.

Friday, Feb 06, 2015 at 1:45pm Where: Cavalry Building (CGWA conference room)

Title: Hidden galaxies and common sense

Presented by: Michael Disney, University of Cardiff

There is very strong evidence that the cosmos is stuffed with Hidden Galaxies, i.e. dim, dark or conversly stellar like Masquerades. Equally there is very strong evidence against this exciting hypothesis. I present both sides of the debate. How should a scientist weigh such conflicting evidence/ It's Common Sense -- yes but how does Common Sense Thinking work?

Friday, Feb 20, 2015 at 1:45pm Where: Cavalry Building (CGWA conference room)

Title: Recent Results in bulk and shear Investigations

Presented by: Matt Abernathy, LIGO Lab-CalTech

Coating Brownian thermal noise is one of the most perplexing fundamental noise sources in advanced gravitational wave detectors. Finding the appropriate way to predict the level of Brownian thermal noise requires both careful theoretic approaches and difficult measurements of material properties. This talk covers new methods of calculating Brownian thermal noise and recent measurements that shed an interesting light on the expected level of noise in the detectors

Wednesday, Mar 4, 2015 at 10:00am Where: Cavalry Building (CGWA conference room)

Title: The nature of spherical collapse and a study of black hole dynamics

Presented by: Sourabh Nampalliwar, UTB

During the merger of binary compact objects, an important stage is the plunge. A short part of the Gravitational waveform, it marks the end of early inspiral and determines the quasinormal ringing (QNR) of the final product of the merger. In this talk we describe the approach of using the Fourier domain Green's function in the particle perturbation approximation to understand the excitation of QNR. We show that the resulting understanding is successful in explaining QNR in toy models and in the Schwarzschild background.

Friday, Apr 10, 2015 at 1:45pm Where: Cavalry Building (CGWA conference room)

Title: Physics of Organic Semiconductor Devices: Materials, Fundamentals, Technologies and Applications Presented by: Alex Zakhidov, Texas State University

Organic electronics and optoelectronics (OE) are fast developing branches of modern science and technology that are aiming to compliment conventional inorganic semiconductors with light, inexpensive, and flexible organic materials. A traditional approach in OE is to build the very same device architecture and optimize different parameters in order to obtain the highest device performance. Practically, this approach proved to be very effective; however, it lacks scientific challenges and thus, obtained fundamental knowledge is marginal. When conceptually a new idea is introduced into device's design, truly novel information can be revealed about mechanisms of device operation resulting in achieving a performance breakthrough. This can be done by using either one or a combination of following strategies: i) new engineering technology for device fabrication, ii) new type of devices, iii) utilization of a new class of materials. In my talk, I am going to show how those strategies facilitate recent progress in the field of OE. In particular, I will describe recently discovered inversion mode organic thin film transistors enabled by molecular doping technology. Another great example of enabling technology is organic friendly orthogonal photolithography technology, which allowed building of e.g. high-voltage organic solar cells, OTFT based circuits and RGB OLED displays. New device architecture creates a new platform to study the property of materials and interfaces. Organic semiconductor microcavities (OMC) e.g. can confine the light on a nano scale and provide a laboratory for semiconductor quantum optics and photonics. Strongly localized Frenkel excitons in organic semiconductors exhibit a much higher binding energy and oscillator strength than the Wannier-Mott excitons found in inorganic semiconductors. In addition, virtually unlimited material design possibilities and low re-absorption due to large Stokes shifts make OMC attractive for studying linear and non-linear optical effects. In our recent work, we experimentally demonstrated that proper design of metal electrodes inside the OMC doesn't negatively affect the lasing threshold. Finally, recently employed new class of materials organic-inorganic halide perovskites made a revolution in thin film solar cells.

CH3NH3PbX3 (X = Cl, Br, or I) perovskites made a rapid progress in power conversion efficiency from 3.8% in 2009 up to more than 20% in 2015. I will make a quick review on that topic and try to explain why this particular class of materials outperforms organic solar cells and what are the challenges facing practical application.

Wednesday, June 10, 2015 at 1:00pm Where: Cavalry Building (CGWA conference room)

Title: Performance improvements in aLIGO Optical Levers

Presented by: Suresh Doravari, LIGO Livingston

The angular motion of core optics in aLIGO are monitored by optical levers. These are simple devices involving a laser beam bouncing off a mirror and a quadrant photodiode (QPD) to monitor the position of the reflected beam spot. The signals from the QPDs are used both as a local reference for monitoring the drift of the optic position as well as in damping its angular motion by feeding the signals back to actuators on the mirror. Optical levers play an important role in the early phases of the lock acquisition in aLIGO as well as in bad weather conditions when microseismic motion (~ 0.1 Hz) is enhanced. During the damping phase it was noticed that power glitches in the diode laser used in optical levers caused the actuators to give a random kick to the optic. Though these were in the 100nrad level it made lock acquisition difficult. After a considerable effort the causes of these glitches were identified and mitigated. In the process we also examined other sources, such as He-Ne lasers, which have much lower intensity noise, as possible alternatives. I will describe the results of our investigation into the pointing noise in aLIGO optical levers and the solutions (both short term and long term) that are in place.

Friday, July 17, 2015 at 3:30pm Where: Cavalry Building (CGWA conference room)

Title: Real vs Bogus & Machine Learning for transient astronomy

Presented by: Bruno Sanchez, Astronomical Observatory of Cordoba and Institute for Theoretical and Experimental Astronomy University of Cordoba

TORITOS project is eager to start working on transient astronomy, expecting new discoveries on this big area soon. We anticipate the data product and its treatment using tools from computer science. The best razor for noisy bogus objects has proven to be a supervised learning algorithm based on transient data.

Friday, August 21, 2015 at 1:45 pm Where: Cavalry Building (CGWA conference room)

Title: The cross-correlation search for stochastic and continuous gravitational wave sources

Presented by:Sanjeev Dhurandhar, IUCAA

The cross-correlation search can be used to map the stochastic gravitational wave (GW) background, as well as track continuous wave sources such as spinning neutron stars. An astrophysical GW background will likely arise from an incoherent superposition of unmodelled and/or unresolved sources and cosmological GW backgrounds (CGWB) are also predicted in certain scenarios. The basic statistic used is the cross- correlation between the data from a pair of detectors. In order to ‘point’ the pair of detectors at different locations one must suitably delay the signal by the amount it takes for the GW to travel to both detectors corresponding to a source direction. Then the raw sky map of the GW background is the signal convolved with a beam response function that varies with location in the sky. The true sky map is obtained by numerically deconvolving the beam function in the integral (convolution) equation by using the maximum likelihood approach. We apply these methods to the Virgo cluster which could be "hot spot" of stochastic GW originating from rotating neutron stars which is a suitable source for this method. We then show how this method can be suitably modified to observe continuous wave sources. This method can be used to trade-off sensitivity with computational cost. This method can be employed for LMXB searches such as Sco X-1.

Dr. Myoung Hwan Kim, Columbia University
MAIN 2.306F (Brownsville) and SWOT 1.204 (Edinburg)
09/03/15

Title:Molding light with flat optics

Abstract: Metasurfaces have emerged in recent years as a platform for designing subwavelength-thick optical components. Such designer optical interfaces introduce spatially-varying optical responses which can mold the wavefronts of light. The reduced dimensionality of optical metasurfaces opens up new physics and leads to novel functionalities distinctly different from those in 3D optical materials. In this talk I will introduce the basic concept of metasurfaces and describe our recent work on using metasurfaces to control light propagation in free space and in optical waveguides. I will first discuss the design and experimental demonstration of an infrared flat lens. I will then show that by integrating optical waveguides with metasurface structures we can realize a group of novel small-footprint and broadband integrated photonic devices, including waveguide mode converters, polarization rotators, and broadband perfect absorbers. Finally, I will describe our on-going work on integrated optical modulators based on metasurfaces loaded with electrically tunable graphene.

Dr. Huidong Zang
Physical Chemistry and Applied Spectroscopy
Los Alamos National Laboratory, Los Alamos, NM
09/10/15

Magnetic and Optical Studies on charge transfer and charge separation in organic/inorganic hybrid Solar Cells:
From Device to Fundamentals

Charge separation and charge transfer are two fundamental photovoltaic processes in organic/inorganic hybrid solar cells. This presentation will cover the photophysics related to theses two key processes under device perspective and then down to single molecular level. The *first* part of the presentation will concentrate on charge separation under device configuration. By using magnetic field effect on photocurrent method, it is successfully demonstrated that singlet and triplet states have positive and negative effect on photocurrent generation based on the device with polymers in their pristine forms. Then, it is revealed that the charge transfer complexes exist at the donor and acceptor interface for double layer structure solar cells, and reducing the formation of charge transfer states can effectively increase the solar cell performance. The *second* part of the presentation will investigate the charge transfer process down to single molecular level. By combining of colloidal quantum dot (QD) with conjugated polymer or fullerene derivative, hole or electron transfer from QD to charge acceptors are studied independently. It is found that the charge transfer rate is dictated by the QDs' core size due its size tunable band gap. More interestingly, the photoluminescence blinking results indicate that only the hole transfer inhibits PL blinking and keeps the QD optically active longer, which is preferable for efficient solar energy conversion.

Dr. Towfiq Ahmed, Los Alamos National Lab
09/14/15
Edinburg: SWOT 1.404
Brownsville: MAIN 1.212

Title: First-Principles Electronic Structure Methods for Complex Systems: From Strongly Correlated Systems to van der Waals Hetero-structures.

Abstract:
As a first-principles method, Density Functional Theory (DFT) has become the modern work-horse of computational physics and material science. Due to both the single-particle and ground-state nature, DFT is often limited for studying low energy physics in strongly correlated systems. But many other systems with weak correlation, DFT is still one of the most preferred and reasonably accurate methods for studying electronic band structure. In this talk, I will systematically investigate a few different areas of material physics including Solar-cell Perovskites, where many-body electronic correlations effects demand us to go beyond conventional DFT. Other avenues, such as van der Waals hetero-structures for designing next generation bio-molecular sensors and Li-ion batteries will also be discussed. Our theoretical study with DFT computation and electronic transport calculations suggest significant DNA base (Adenine, Guanine, Cytosine, Thymine) dependent features within a few eV of the Fermi level.

Dr. Hamidreza Ramezani, University of California Berkeley
09/17/15
UBLB 3.102 (Brownsville)
REIN 1.102 (Edinburg)
Title: Mastering waves with non-Hermiticity

Abstract: Effective and full control over wave transport, highly desired goal in all branches of science and technology, is a grand challenge. Synthetic materials offer novel platforms to convey waves in an effective way. More specifically in nano-photonics, meta-materials with specific constitutive optical parameters are realized. However, intrinsically these materials are lossy which degrades the efficiency of the devices. To minimize the effect of losses, naturally one incorporates gain materials to eliminate losses.
In recent years, we have taken an opposite approach, namely we incorporate loss and gain in a judicious way to enrich wave dynamics in optical systems. Such non-Hermitian systems obey parity-time (PT) symmetry.
In my talk, I will introduce the notion of PT symmetry in photonics. Briefly, I will discuss dynamical properties of such systems. Later, I will describe scattering in non-Hermitian systems. Among all interesting features such as asymmetric transport, coherent perfect absorber-laser, etc, I will discuss two of my contributions in the field of non-Hermitian photonics: unidirectional lasing and unidirectional invisibility.Although there are several open channels in a unidirectional laser cavity, emission of laser beam occurs from a specific channel. Such cavities have potential applications in aviation, logic elements, etc.
In the unidirectional invisibility problem, the entire optical system is invisible when illuminating light from one end but not from the other. To achieve such anomalous scattering process we use interferences to vanish reflection (from one side) and phase of traveling waves in a 1D PT symmetric potential while we keep the transmission coefficient to be one.