2020 End of Summer Symposium Program
October 9, 2020

Symposium Schedule Overview

Keynote Address 3:00-3:45pm	Catheryn Wilson Ph.D. Candidate, University of Arkansas for Medical Sciences (UNCP, B.S. Biology, 2015) *"Real Dangers of 'Fake' Weed: A Graduate Student's Research Journey"* *https://uncp.webex.com/meet/fatima.oliver*		
Poster & Oral Presentation: Concurrent Sessions 4:00-6:00 pm	Molecular Biology, Biochemistry & Biotechnology Moderator: Dr. Rachel Smith *https://uncp.webex.com/meet/rachel.smith*	Ecology & Environmental Science Moderator: Dr. Bob Poage *https://uncp.webex.com/meet/PoageRoom*	Chemistry, Physics & Computer Science Moderator: Prof. Sailaja Vallabha *https://uncp.webex.com/meet/sally.vallabha*

Poster and Oral Presentation Schedule: Concurrent Sessions

Time	Presenter(s) Name	Mentor's Name	Presentation Title
Molecular Biology, Biochemistry, and Biotechnology **Moderator: Dr. Rachel Smith** *https://uncp.webex.com/meet/rachel.smith*			
4pm	Mercedes Dos Santos	Dr. Maria Santisteban	Annotating G. Species venom gene GAIW01001201.1 with the conservation of Nasonia vitripennis https://youtu.be/1HoY2amCT9w
4:15pm	Minh Huy Giang	Dr. Ben Bahr	Exercise-mimetic Drug Protects Against Age Cognitive Decline Associated with Alzheimers Disease and Other Related Dementia https://youtu.be/CeLt2uVN2m0
4:30pm	James Locklear	Dr. Ben Bahr	NCAM Break Down Products (NBDPs) as a "Potential Biomarker" for Neurodegenerative Diseases https://youtu.be/_P0PaPFwrxw
4:45pm	Shamon Mercier	Dr. Courtney Alexander	Using C.elegans to model human bones https://youtu.be/pNvQAY0lLsY
5pm	Ashley Edwards	Dr. Courtney Alexander	Research Suggests Local Plant Extracts Influence hsp-70 & Apoptosis in C. elegans https://youtu.be/KWhRXxcV4Vs

5:15pm	Yaqot Nasser, Savannah Chappell, Maya Grimes, and Lauren Bostick	Dr. Sivanadane Mandjiny and Dr. Steven Singletary	Continuous Biodiesel Production II: Purification Via Silica Gel Columns https://youtu.be/A6i4Qjd-0eQ
Ecology and Environmental Science **Moderator: Dr. Bob Poage** *https://uncp.webex.com/meet/PoageRoom*			
4pm	Casey Richardson	Devang Danny Upadhyay	Effect of Environmental Factors on Growth Kinetics of Biocontrol Agent Bacillus thuringiensis Bacterium using 2L and 5L A+ Sartorius Stedim Biostat® Fermentation Systems https://youtu.be/nAzHINaLe_8
4:15pm	Katina Oxendine	Dr. Maria Pereira	Comparison of Ginger Propogation Techniques https://youtu.be/DAaYU-E7-n0
4:30pm	Bailey Teale	Dr. Lisa Kelly	Wildflower Field Guide for Green Swamp Nature Preserve https://youtu.be/CJ83DDeDwwo
4:45pm	Macaela Locklear, Abigail Canela	Dr. Kaitlin Campbell	Pollinator gardens as a haven for overlooked biodiversity https://youtu.be/RQGSlWQXk8k
5pm	Aalayza Blackshear	Dr. Amber Rock	Examining the effects of an agricultural and urban area on water quality and benthic macroinvertebrate diversity in the Lumbee River https://youtu.be/1QFODZCqOhA
5:15pm	Zachery Bayles	Dr. John Roe	Brumation Ecology of the Eastern Box Turtle (Terrapene carolina carolina) https://youtu.be/vP-M9hdBFBE
Chemistry, Physics, and Computer Science **Moderator: Prof. Sailaja Vallabha** *https://uncp.webex.com/meet/sally.vallabha*			
4pm	Samantha Cranford	Dr. Paul Flowers	Testing the Efficiency of Organic Liquid Drying Agents Using Gas Chromatography-Mass Spectrometry https://youtu.be/ItsGwpdI754
4:15pm	James W. Graham	Dr. William Brandon	Cosmological Implications of the Planck Charge Oscillator Model https://youtu.be/gWXaFdOKrgE
4:30pm	Evert Garcia-Guzman	Dr. William Brandon	On the Origin of Matter Waves https://youtu.be/H36tYRC5ooQ
4:45pm	Tristan Dwyer, Evert Garcia-Guzman, James W. Graham	Dr. William Brandon	The Emergence of Special Relativity from an Ideal Universal Oscillator https://youtu.be/k6mBKHpR5-Q

5pm	Luke Fleming	Dr. Joong-Lyul Lee	Barrier Coverage Construction without Barrier Breach using Logical Vector in Wireless Sensor Networks https://youtu.be/Hkx4Q3zKisE
5:15pm	Jared Tuton	Dr. Ben Bahr	Chemical similarity and its application in drug discovery https://youtu.be/LUyayvEgo08

Posters (Video unavailable)

Student(s) Name	**Mentor's Name**	**Presentation Title**
Kelsey Crowley *Molecular Biology*	Dr. Maria Santisteban	Comparing D. ananassae and D. melanogaster Genes Click here to view poster
Lois Renee Hoot *Environmental Science*	Dr. Lisa Kelly	Lumbee Medicinal Plant Database via: Southeast Regional Network of Expertise and Collections; SERNEC Portal Click here to view poster
Blanca Trejo-Muñoz, Minerva U. Martinez, and Danaisha Moore *Chemistry and Physics*	Dr. Sivanadane Mandjiny and Dr. Steven Singletary	Continuous biodiesel production I: Trans-Esterification via Sonication Click here to view poster

Abstracts

Effect of Environmental Factors on Growth Kinetics of Biocontrol Agent Bacillus thuringiensis Bacterium using 2L and 5L A+ Sartorius Stedim BiostatÂ® Fermentation Systems

Presenter(s): Casey Richardson
Mentor: Devang “Danny” Upadhyay

Abstract: Bacillus thuringiensis (Bt) is a soil-dwelling, Gram-positive bacterium that is used as a biological pesticide and used to genetically engineer plants due to the toxic proteins it produces. B. thuringiensis was studied in batch cultures to determine the specific growth rates and doubling times. The purpose of this experiment was to research the growth kinetics of Bacillus thuringiensis in a 2L bioreactor and a 5L bioreactor containing growth media at different environmental conditions. Fermentation parameters were controlled by utilizing a Sartorius Stedim Biostat® A+ bioreactor system for bacterial growth. The environmental conditions included temperature, agitation, and aeration. The specific growth rates of B. thuringiensis were determined. The optimal conditions for the 2L bioreactor were 200 RPM, 30°C, 1.5 VVM, and with the highest specific growth rate 0.2974 h-1 and the lowest doubling time 1.0122 hr. For the 5L bioreactor, the optimal conditions were 150 RPM, 30°C, 1.5 VVM, and with the highest specific growth rate 1.1557 h-1 and the lowest doubling time 0.2605 hr.

Comparing D. ananassae and D. melanogaster Genes

Presenter(s): Kelsey Crowley
Mentor: Dr. Maria Santisteban

Abstract: The Genomics Education Partnership (GEP) helps educators use research opportunities to teach bioinformatics and genomics to students. GEP does this by using a genome browser to allow students to explore different genes of many different species. For this project contig19 of D. ananassae was compared to genes of D. melanogaster using this browser. Contig19 contains 5 features which were compared to orthologous genes of D. melanogaster. By comparing the two using this program, insights were gained into their evolutionary relationship. Using research-based education like GEP allows students to learn information about their subject while gaining real world knowledge to prepare them for their future careers.

Annotating G. Species venom gene GAIW01001201.1 with the conservation of Nasonia vitripennis

Presenter(s): Mercedes Dos Santos
Mentor: Dr. Maria Santisteban

Abstract: Genomic Education Partnership (GEP) is a collaborative genomic database that provides the opportunity for researchers and undergraduate students to collectively work together to take raw DNA sequence data and annotate them using various tracks. In this project, the venom gene GAIW01001201.1 from the G.Species was annotated using RNA sequence data, Transcripts assembled by Stringtie, and SPALN alignments from Nasonia vitripennis (N. vitripennis) on the GEP genome browser. Identified and confirmed conservation was found between the LOC100114397 gene in N. vitripennis and GAIW01001201.1 facilitating the ability to map the coding sequences of GAIW01001201.1.

Drosophila ananassae Sep. 2019 (GEP/Muller F Element) Assembly contig 50

Presenter(s): Mariam Qambar, Timothy Hinton
Mentor: Dr. Maria Santisteban

Abstract: Drosophila melanogaster is a well-known species that has been thoroughly annotated. Its genome sequence has been used in comparative genomics approaches to annotate newly sequenced species of other Drosophila species. The rationale is that important proteins would be conserved through evolution and hence, the coding parts of the genes would be conserved in between the D. melanogaster and the species to be annotated. For this work, undergraduate and graduate students were tasked with identifying and annotating genes in a region of the newly sequenced Drosophila ananassae. Gene prediction or gene finding refers to the process of identifying the regions of genomic DNA that encode genes; gene annotation refers to the process of “labelling” the different parts of the gene. Students used several lines of evidence ranging from conservation, to RNAseq data, to computer generated gene predictions, to algorithms that predict intro/exon boundaries to annotate their project. By completing this annotation project, students are introduced to various bioinformatics tools (BLAST, UCSC genome browser mirror) and databases (Flybase, NCBI) and are provided with the opportunity to cooperate with scientists from the Biology Department at the McDonnell Genome Institute of Washington University in St. Louis, the creators of the GEP Browser. The project to be annotated was a 400,000 bp region (contig 50) in the Muller F element of the D. ananassae species. There were three genes located within this region. They were Eph which had 6 isoforms, CaMKI with 5 isoforms, and msk with 1 isoform. Evidence provided by the Gene Model Checker suggest that the predicted annotations of contig50 were likely correct.

Continuous Biodiesel Production II: Purification Via Silica Gel Columns

Presenter(s): Yaqot Nasser, Savannah Chappell, Maya Grimes, and Lauren Bostick
Mentor: Dr. Sivandane Mandjiny and Steven Singletary

Abstract: Many different processes have been investigated to produce biodiesel from various triglyceride feedstocks. Both batch reactions and continuous flow processes have been developed in an effort to lower the production costs of biodiesel to make it competitive with diesel fuel derived from crude oil. All production methods currently produce a mixture of biodiesel, catalyst and unreacted oil feed stock that must be purified before the fuel can be distributed for use. We report the results of a project designed to develop a continuous production cycle for biodiesel. This work focuses specifically on the purification of the mixture as it exits the trans-esterification process. Current methods rely on a density-driven process in large settling tanks. While effective, this stop in the biodiesel production process adds significant time as the mixture separates, tanks are emptied and cleaned before a new batch can be processed. Purification in this work is accomplished by forcing the mixture through a silica-gel column via a pressure differential. Column height and diameter, flow rates and pressure differentials are varied in order to achieve continuous purification as the mixture exits the trans-esterification process.

Exercise-mimetic Drug Protects Against Age Cognitive Decline Associated with Alzheimerâ€™s Disease and Other Related Dementia

Presenter(s): Minh Huy Giang
Mentor: Dr. Ben Bahr

Abstract: Alzheimer’s disease (AD) is one of the most common types of dementia. In addition to impairing cognitive function, AD is a progressive and age-related disease. It takes 15-20 years before the first noticeable symptom appears, a time at which the disease has already been advanced and followed by a severe cognitive decline. One common pathology of AD is the aggregation of amyloid beta and tau protein, both of which inhibit the synaptic signal transmission between neurons and eventually accounts for neuronal loss (Hwang et al. 2019). Interestingly, one way to minimize the risk of AD is physical exercise, which has been found to enhance synaptic integrity by the modulation of brain-derived neurotropic factor and cathepsin B, a lysosomal enzyme that can clean up these protein plaques (Moon et al., 2016). This approach, however, is impractical for many patients above 75 or those with disabilities. Therefore, a drug mimicking the neurogenerative effect of exercises can be a potential alternative for patients who are incapable of doing exercises. This study examines the effect of exercise-mimetic drug β-GPA in 36 mice from three age groups, half of which were treated with β-GPA for 6 weeks. Then, SAB tests and open field test were conducted to observe the cognitive behavioral effect. After these tests, a biomarker analysis will be performed to assess the molecular effect of β-GPA. Through preliminary analysis, β-GPA appears to have cognitive protection associated with improvement of the synaptic integrity.

NCAM Break Down Products (NBDPs) as a "Potential Biomarker" for Neurodegenerative Diseases

Presenter(s): James Locklear
Mentor: Dr. Ben Bahr

Abstract: Neurodegenerative disorders rank 5 in causes of worldwide death. Alzheimer's disease is a continual loss of synaptic function that correlates with rapid loss of cognitive ability, due to neuronal cell disintegration. Phosphorylated tau proteins (pTau) and amyloid plaques block signaling and nutrients, both intracellularly and extracellularly. Neuronal cell adhesive molecules are proteins essential for neurite elongation and play an important role in synaptic function. NCAM's are synthesized by proteases or enzymes, or exposure to harsh environments, then isoforms and neuronal break down products from the NCAM protein are formed. Calpain is an extracellular protease that can be used to modify NCAM's to obtain different isomers and other proteins that can be studied (A. Sheppard et al. 1991 Biochim Biophys Acta 1076(1):1056-60). When mouse hippocampal slices were exposure to a blast from RDX, a military explosive, NBDP at 70kDa and 35kDa increased with long exposure, while proteins that support synaptic function such as GluR1, Synaptophysin, and Synapsin IIb declined (Bahr et al. 2002, Exp Neurol 174:37). Modified proteins and break down products of NCAM should be studied to further understand their functions and correlation between NBDP and neurodegenerative disorders.

Using C.elegans to model human bones

Presenter(s): Shamon Mercier
Mentor: Dr. Courtney Alexander

Abstract: A little over 50 years ago, Sydney Brenner had the foresight to develop the nematode Caenorhabditis elegans as a genetic model for understanding questions of developmental biology and neurobiology. Caenorhabditis elegans is a tiny, free-living nematode found worldwide. These nematodes are great for genetic analysis because they are self-fertilizing. This summer was spent learning the basics of C. elegans and determining my question that I would want to answer which would be how we could cure structural diseases in humans in particular bone diseases by experimenting with this nematode.

Barrier Coverage Construction without Barrier Breach using Logical Vector in Wireless Sensor Networks

Presenter(s): Luke Fleming
Mentor: Dr. Joong-Lyul Lee

Abstract: In wireless sensor networks, the barrier coverage detects objects crossing a protected area or monitors an area of interest. It is an important application in the wireless sensor networks. In such a wireless sensor network application, sensor nodes are randomly deployed along the boundary of the monitoring area due to cost issues and construct multiple barrier coverage in order to maximize the network life time. These multiple barriers are operated according to the sleep-wakeup schedule. In this application, a new security problem which is the barrier breach problem occurs in the sleep-wakeup schedule. In this work, we propose a new barrier coverage construction algorithm without barrier breach using logical vector.

Chemical similiary and its application in drug discovery

Presenter(s): Jared Tuton, Nicholas Willard
Mentor: Dr. Ben Bahr

Abstract: The chemical similarity principal illustrates the strong correlation between chemical structure and its bioactivities. Understanding and manipulating chemical similarity networks can be used to increase the Pharmaceutical impact of new medicinal drugs via structural analogs. MACCS Keys (structural keys), the tanimoto Index, 2D, and 3D structural analysis provide a means of adequately assessing the chemical similarity between two compounds. Through these methods, and various bioactivity databases we can take advantage of the chemical similarity principal to reduce medicinal drug failure, increase pharmaceutical impact, and have a better prediction of a drugs biological and chemical pathways.

Research Suggests Local Plant Extracts Influence hsp-70 & Apoptosis in C. elegans

Presenter(s): Ashley Edwards
Mentor: Dr. Courtney Alexander

Abstract: Cancer cells are able to undergo proliferation without interference from apoptosis as a result of mutations in the cells. C. elegans are a model organism to study cancer pathways, tumorigenesis, and apoptosis. These nematodes have many conserved genes and pathways, and their transparency allows cells to be monitored directly. Via heat shock (HS) we can simulate illness in C. elegans, and then treat them afterwards with plant extracts local to North Carolina. We plan to monitor the levels of hsp-70 and bcl-2 using a western blot. We must first determine how the plant extracts influence these protein levels before we use mutant strains to discover the affect on apoptosis. BS3164 and GC565 are temperature sensitive C. elegans

strains that cause tumorigenesis in the germline. Prior to running the experiment, the nematodes will be age-synchronized and FUdR will be kept on the plates to prevent untreated C. elegans eggs from hatching after they are expelled from the vulva of treated C. elegans. Before dividing the worms into treatment and control groups, they will undergo HS. Every 1-3 days, the plates will be examined to score deceased nematodes. One, five, seven, and ten days following exposure to the plant extract, a western blot will be performed to measure protein levels. Our goal is to determine which plant extract significantly increases apoptosis as a potential drug to treat cancer.

Comparison of Ginger Propogation Techniques

Presenter(s): Katina Oxendine
Mentor: Dr. Maria Pereira

Abstract: The methods for sprouting ginger are many and the purpose of this experiment was to put several methods against one another to see which would be the most consistent. The method of sprouting was narrowed down to three different rhizome preparations and four planting treatments. The rhizome was either cut on the bias, broken and calloused, or broken and placed into the soil with the open wound. The treatments were potting soil with no amendment, potting soil with fertilizer, water with no amendment and water with the initial batch containing fertilizer. These twelve methods were then replicated for a total batch of twenty-four experimental units. These twenty-four were replicated twice for a total of seventy-two experimental units in batches of twenty-four. Each batch was placed into different conditions: one went to the growth chamber set at 32C, one stayed at room temperature at 24C, and the last batch went on heating pads at 29C. Each of these batches were given fresh distilled deionized water every other day and their growth recorded. All water treatments ended up as a failure within ten days, where as the rest of the batches showed positive growth rather than terminating. After recording the growth for a month of time and comparing the growth statistics and averages, it was found that the growth chamber gave the most consistent growth, with all sprouts coming up the same day and experiencing a good rate of growth in comparison to the other treatments, which while successful, took much longer.

Wildflower Field Guide for Green Swamp Nature Preserve

Presenter(s): Bailey Teale
Mentor: Dr. Lisa Kelly

Abstract: The purpose of this project was to create a field guide for wildflower species that are found in the Green Swamp Preserve. This guide would be written to be approachable by any lay-person and meant to be user-friendly. The goal of the guide would be to educate as well enthuse readers about different species unique to the habitat found at the preserve. Promoting biodiversity is a key element in protecting species for future generations. Educating and

encouraging others to enjoy the beauty of these species can lead to further appreciation for preserves. Over the course of the summer research, hundreds of photographs were sifted through and categorized for future use. Progress was made towards making an appealing template for the field guide's pages. Species were documented as far as what photos we had, and information was gathered and formatted into entries for a handful of species. This project is far from complete, but the work done may prove a valuable starting point for future progress.

Pollinator gardens as a haven for overlooked biodiversity

Presenter(s): Macaela Locklear, Abigail Canela
Mentor: Dr. Kaitlin Campbell

Abstract: Pollinators are an important part of our everyday lives, assisting in the pollination of most of the world's flowering plants, including much of the produce we consume. Hoverflies are a diverse group of pollinators often overlooked in North American research. They rely on nectar, pollen, and aphids during their life cycles. We wanted to determine if pollinator gardens affect hoverfly diversity and which flower varieties they prefer. We hypothesized that pollinator gardens provide a diverse range of floral resources, increasing hoverfly diversity. We further hypothesize that flower color and ease of nectar access affect floral use. For 8 sampling periods across two years, pan traps were used in the lawn and garden of two sites (UNCP and RCC). A total of 71 plots of 70 flower varieties were observed for 15 minute intervals to determine hoverfly visitation rates. We collected 92 total hoverflies of 5 different species in pan traps. UNCP's pollinator garden showed higher abundance of hoverflies than the nearby lawn, however, there was no significant difference at RCC. During 70 hours of floral observations (216 hoverfly visits), we saw that hoverflies only visited 26 of the 70 available flower varieties. The results from the UNCP site seem to confirm that pollinator gardens increase hoverfly abundance. We also found that hoverflies seem to prefer warm colored flowers with easily accessible nectar and pollen. Hoverflies can be a great benefit to our native plants, gardeners, and even farmers who may want to attract both pollinators and predatory insects.

Examining the effects of an agricultural and urban area on water quality and benthic macroinvertebrate diversity in the Lumbee River

Presenter(s): Aalayza Blackshear
Mentor: Dr. Amber Rock

Abstract: Runoff from human-impacted areas can pollute nearby rivers, decrease water quality, and be harmful to aquatic organisms. Nitrogen and phosphorus runoff are common in agricultural areas, and urban areas can be a source of contaminants to nearby rivers. Water quality in the Lumbee River was evaluated at 6 different sites that stretched from the headwaters to near the South Carolina border. The first three sites (Chalk Banks, Recreation

Center Rd, and Sampson's Landing) were focused on potential agricultural impacts to the river. Two sites (McNeil's Bridge and High Hill) were focused on potential impacts of an urban area (Lumberton, NC). The last site, Fair Bluff, was used to assess the extent to which the river recovered from agricultural and urban inputs after flowing through a less-impacted area for several miles. The open-source computing program R was used to analyze and graph the collected data. Our data suggest that the Lumbee River is not strongly impacted by agricultural or urban inputs, because all variables we measured indicated little to no change in water quality between sites.

Brumation Ecology of the Eastern Box Turtle (Terrapene carolina carolina)

Presenter(s): Zachery Bayles
Mentor: Dr. John Roe

Abstract: Although the Eastern Box Turtle (Terrapene carolina carolina) is not listed as an endangered species, recent population declines have resulted in their designation as a conservation priority. Prescribed fires are used to manage long-leaf ecosystems and other woodland habitats occupied by T. carolina. During winter months, T. carolina burrow under litter and soil layers to protect themselves from environmental hazards. This study aimed to examine turtle overwintering ecology to assess potential response to controlled burns at Lumber River (LRSP) and Weymouth Woods (WEWO) using data collected over seven years. Prior brumation ingress, data loggers were epoxied to turtle carapaces and fixed to a nearby stake at gradient depths to record turtle shell (Ts) and environmental temperatures (Te). Data showed turtles were deepest on 24 Feb, when turtles were 3.2 ± 0.7 cm and 2.9 ± 0.9 cm below litter interface at LRSP and WEWO, respectively. Individual turtle emergence times at both sites varied from 8 Mar – 3 May. The average WEWO emergence occurred on April 05, while Lumber River emergence took place on 9 Apr. Between 2012-2020, WEWO had 8 active season (Apr-Nov)burns in turtle occupied areas that resulted in 3 turtle deaths, 1 with a burned shell, and left 4 unharmed. Inversely, 7 overwinter burns left turtles unscathed. While turtle depth and emergence timing amongst individuals varied, depth and emergence was repeatable across populations at both sites. These findings suggest fire managers could potentially reduce the harmful effects of prescribed burns on turtle populations by conducting burns during overwintering when turtles are dormant.

Testing the Efficiency of Organic Liquid Drying Agents Using Gas Chromatography-Mass Spectrometry

Presenter(s): Samantha Cranford
Mentor: Dr. Paul Flowers

Abstract: Organic solvents are used by various industries to create important medications and specialty chemicals, and by academic institutions to conduct research and to teach future

generation of scientists. In many applications, even very small amounts of water contamination can adversely affect the performance of the organic liquid. The goal of this project was to apply a recently developed analytical method for measuring trace amounts of water in organic liquids to development of an undergraduate curricular lab experiment. The analytical method used was the common and powerful technique of gas chromatography-mass spectrometry (GCMS), which enables the separation, identification and quantification of volatile mixture components. We applied the GCMS method to evaluate the efficiencies of two common drying agents, anhydrous calcium chloride and zeolite-based molecular sieves, by investigating the effects of contact time and desiccant-to-liquid mass ratio.

The Emergence of Special Relativity from an Ideal Universal Oscillator

Presenter(s): Tristan Dwyer, Evert Garcia-Guzman, James W. Graham
Mentor: Dr. William Brandon

Abstract: It has become widely accepted among physicists that the structure of space-time is not continuous. Here we show that attributing space-time and matter as an integrated form of an ideal oscillator, without explicit details as to the structure of the oscillator, leads quite naturally Lorentz-Fitzgerald length contraction and time dilation associated with the special theory of relativity, an addition to the relativistic energy-momentum expression. The viewpoint herein, although mechanically abstract, is more in tune with modern quantum field theory in that an object should no longer be considered as a passive actor on a space-time stage as the standard introduction to Einstein's theory of special relativity implies. Essentially, we show how special relativity emerges from the mathematical form of an ideal oscillator, more explicitly - the total energy of the ideal oscillator.

On the Origin of Matter Waves

Presenter(s): Evert Garcia-Guzman
Mentor: Dr. William Brandon

Abstract: A simple description of matter waves lending itself quite naturally to further development in introductory modern physics pedagogy follows from the notion that inertial mass originates from the special relativistic effects of a resonant coupling between the zero-point field and charge. Using basic algebra to investigate the energy dispersion of the free electron It appears that matter waves might be attributed to a modulated wave formed by superimposing the intrinsic set of randomly phased, Lorentz transformed, Doppler shifted electromagnetic waves. Essentially, matter waves are the result of zero-point-field driven resonances modulated at de Broglie frequencies. This is a very simple version of an interpretation rigorously described earlier by researchers in the field of stochastic electrodynamics. The attraction to such an approach, for those so inclined, is the simplicity afforded in returning to an old-fashioned mechanistic understanding of the universe and an

effort to break from established Copenhagen doctrine. Such a framework is provided by researchers working in the realm of stochastic electrodynamics.

Cosmological Implications of the Planck Charge Oscillator Model

Presenter(s): James W. Graham
Mentor: Dr. William Brandon

Abstract: The Planck scale is widely accepted as the natural minimum scale, which can be synthesized from the fundamental constants relating relativity, gravity, and quantum physics through c, G, and h respectively. However, the Planck scale is well beyond those encountered in real life and hardly verifiable via accessible experimentation. The scale governing our known universe is the Compton scale, which is also fundamental in the same sense -- it is made up of fundamental micro physical constants. Although the Compton scale is some 20 orders of magnitude beyond the Planck scale. We suggest here a mechanism, the so-called “Planck charge”, by which the Planck scale manifests itself at the accessible Compton scale – through processes at the Planck time, which give birth to mass as an entirely emergent, as opposed to fundamental quantity. Related issues, mainly those involving an emergent gravity and electromagnetism, along with several cosmological implications are also presented.