CONFERENCE PROCEEDINGS

Listed below are abstracts of student-faculty collaborative work presented at regional, national, and international conferences.

Mitchell Revalski
(Paul Wiita, Faculty Sponsor)
Exploiting Kepler to Study Quasar Variability
Presented at the 221st American Astronomical Society Meeting, Long Beach, CA, January 6-10, 2013
Variability of emission across all bands on both short and long-term time scales is a defining feature of active galactic nuclei. We present here an analysis of the optical light curves of four flat spectrum radio loud quasars, highlighting the two most recently released quarters of Kepler satellite data. Long cadence data sets were analyzed to search for flare activity and potential variability. Power spectral densities (PSDs) were used to probe for periodicities and to characterize the variability. We analyzed the raw data and also analyzed that same data after we made corrections to remove artifacts including null values, downlink gaps, and thermally induced irregularities. Often significant differences arose in the PSDs due to these corrections. The standard Kepler pipeline reduction was found to remove nearly all of the long-term variations in question. Additionally, we applied end matching to the raw corrected data so as to remove a first-order linear term; this should improve the accuracy of the PSDs. Average PSD slopes for the raw and end matched data sets were α = -1.76 and -1.60, respectively. These values are consistent with ground-based analyses of other quasars and blazars. One of our objects showed significant but modest flare activity whereas the others were in low activity states. No significant periodicities or quasiperiodicities were detected for these objects. This work was supported in part by NASA Kepler GO Grant NNX11AB90G to SSI and MUSE funds at The College of New Jersey.

Gabriel Randazzo and Lisa LaJevic
(Lisa LaJevic, Faculty Sponsor)
Cleaning Our World Through Art: Exploring Ecology Through Contemporary Art.
Presented at the National Art Education Association (NAEA) Conference, Ft. Worth, TX, March 7-10, 2013
Recent literature suggests the importance of incorporating contemporary art in the classroom (Mayer, 2008; Walker, 2001). Often exploring global issues, contemporary art investigates interdisciplinary themes that are prevalent in everyday life/culture, and challenges viewers/students to examine issues and formulate their own beliefs. Highlighting this philosophy, our presentation focuses on how contemporary artists who explore important ecological issues can be incorporated into the art classroom. Investigating artists such as Moose, Scott Wades and Alexandre Orion, and their working with reverse graffiti, an ecological reductive artmaking process that is created by removing dirt from a surface, we offer practical, innovative lesson ideas that integrate art with science. Supporting the conference theme, we explore global environmental issues such as pollution, and creative lessons that make a difference by actively cleaning up our community/ies through art. This presentation helps push traditional art education boundaries by promoting student understandings of art, ecology, world, and self.

Jessica Scardino
(Lynn Gazley, Faculty Sponsor)
Religious Attendance and Happiness: An Application of Interaction Ritual Theory
(1) Presented at the 83rd Annual Meeting of the Eastern Sociological Society, Boston, MA, March 21-24, 2013
(2) Presented at the 83rd Northeast Regional Honors Council Conference, Philadelphia, PA, April 4-7, 2013
(3) Presented at the 108th Annual Meeting of the American Sociological Association, New York, NY, August 10-13, 2013

Previous research on the relationship between religiosity and happiness has emphasized that happiness results from the social cohesion experienced by belonging to a faith community and the development of positive coping skills. I propose that this relationship can also be explained using "Interaction Ritual" Theory (Collins 2004). Using data from the 2010 General Social Survey (GSS), this study examines the relationship between religiosity and happiness using a binary logistic regression. Findings indicate that when controlling for age, race, sex, and socioeconomic status, there is a positive relationship between the frequency of religious attendance and increased happiness levels. I then explain these findings considering religious services as an "Interactional Ritual" (Collins 2004). While this study uses an application of "Interaction Ritual" Theory in order to explain the positive relationship between happiness and religious attendance, the quantitative analysis may serve to support elements of Collins's theory by providing a measurable dimension of the emotional effects of ritual participation.

Francisco Estevez and Shahzore Qureshi
(S. Monisha Pulimood, Faculty Sponsor)
Students Organizing Against Pollution: Computational Thinking Across Boundaries
Presented at the ITiCSE 2013 ACM SIGCSE Conference, University of Kent, Canterbury, United Kingdom, July 1-3, 2013.
There is a growing need in computer science education to develop courses that demonstrate the articulations between computer science and an array of computing-dependent fields. This poster describes an effort to develop a model for students and faculty to collaborate across disciplines and with a community organization to develop computational solutions to address complex real-world problems. Students in computer science classes are collaborating with students in journalism classes and Habitat for Humanity, to develop a web-based system that manages pollution related data. This is an initiative aimed at empowering citizens in the Trenton area of New Jersey with the opportunity to learn, share, and contribute pollution data while encouraging them to become participants in environmental advocacy and public policy deliberations on these issues. While students focus on the objectives of the individual courses, they are also deeply engaged in the complexities of privacy, security, accessibility of data, user-centered design, etc. as they ponder civic justice issues.

Amanda Soler, Tiffany Piatt, Leeann Thornton
(Leann Thornton, Faculty Sponsor)
Molecular genetic and biochemical analysis of the role of CYP72A cytochrome P450s in regulating plant growth
Presented at the American Society of Plant Biologists National Conference, Providence, Rhode Island, July 20-24, 2013
Plant metabolic responses to environmental conditions require thousands of enzymes that must work in delicately balanced concert to facilitate plant growth and defense against pests. Plants with the most tightly regulated metabolism and growth are more likely to thrive. The cytochrome P450s (CYPs) are a group of enzymes that catalyze biochemical reactions in all organisms, and they are particularly important in plant metabolism. There are hundreds of CYPs in plants, and they are grouped into subfamilies based on genetic similarity. Our approach is to combine a molecular genetic analysis with biochemistry to describe subtle differences in apparently redundant CYPs from Arabidopsis. The CYP72A subfamily appears to contribute to producing defensive secondary metabolites in response to stress and herbivory. The subfamily is found in all plants but appears to be diversifying in recent evolutionary history. We are examining double and triple mutants to determine the role the enzymes play in maintaining optimal plant growth in Arabidopsis. We are examining the structural constraints of the subfamily that will provide insight into the biochemical activity of the group from multiple plants. We are also optimizing expression of the CYP72A enzymes in yeast for direct analysis of substrate interactions. This work provides insight into the ongoing evolution of plant genomes and the metabolites produced by CYP72As.

Shannon Grooms
(Emily Bent, Faculty Sponsor)
(Re)theorizing the Margins: A Comparative Analysis of Gloria Anzaldua's Borderdweller and Kate Bornstein's Gender Outlaw
Presented at the 22nd Annual Women and Society Conference, Poughkeepsie, NY, October 25-26, 2013
This paper is a comparative analysis of Gloria Anzaldua's conceptualization of the border dweller (1987), and Kate Bornstein's gender outlaw (1994). It underscores the theoretical similarities between these two divergent concepts, and in doing so, provides a framework for understanding the experiences of those forced to exist outside of culturally and geographically enforced binaries. The author reads Anzaldua's, *Borderlands/La Frontera: The New Mestiza* as a queer text, and places central concepts such as: the border dweller, the coalitque state, and new mestiza consciousness into direct conversation with Bornstein's theories on gender and male privilege, in *Gender Outlaw: On Men, Women and the Rest of Us*. Based on this theoretical analysis, the author suggests that the border dweller and gender outlaw experience parallel identities from the spiritual and physical consequences of being 'caught in between'. Where the *border dweller* experiences a hybridity that comes from the two locational oppositions, (i.e. the US/Mexico border), the *gender outlaw* experiences this hybridity as two oppositional genders, or the feeling of being neither fully male nor fully female. Taken together, this paper proposes that the border dweller and the gender outlaw offer us a new understanding of the margins and the marginalized experience than previously conceptualized in feminist scholarship.

Nahrin Ahmed
(Blythe Hinitz, Faculty Sponsor)
Umar and the Bully: Teaching Anti-Bullying to Muslim-American Students
Presented at the World Organization for Early Childhood Education (OMEP USA) Conference, Washington, DC, November 21, 2013
This lesson was designed to enhance the development of minority students in activating specific background knowledge to teach anti-bullying. The intended goal is to increase participation through the use of information by making it familiar to minority populations. The lesson about anti-bullying is meant to address the role of the bystander to protect a victim of bullying. Elementary anti-bullying school lessons are commonly taught to the largest population of students to address the needs and issues of the majority. However, lessons tailored to specific subsets of students have shown positive gains in overall students' social/emotional wellbeing and their academic achievement (Macpherson, 2009). The anti-bullying lesson I covered was taught to fourth-grade students of Muslim-American background and their parents of Arab and/or South Asian ethnicity. We used the book, *Umar and the Bully*, by Shabana Mir, which tells a story about an incidence of bullying taking place at an Islamic school. We used this to discuss bullying and responses to bullying in terms, linguistically and religiously, specific to this population. The purpose of the lesson was to give Muslim students understanding of anti-bullying concepts taught in public schools by accommodating it to their populations' unique set of terminology and surroundings. Five months after the lesson was taught, the following school year, now as fifth-grade students, they revisited the lesson of *Umar and the Bully*. The students anonymously responded to how they would handle the role of a bystander from both religious and individual points of view. The students' answers showed their tendencies in responding to bullying as a bystander, to have an ingrained religious element.
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Mitchell Revalski
(Paul Wiita, Faculty Sponsor)
Investigating AGN Variability Using Combined Multi-Quarter Kepler Data
Presented at the 223rd American Astronomical Society Meeting, Washington, DC, January 5-9, 2014
The study of long- and short-term variability in active galactic nuclei (AGN) yields deeper insight into the physical nature of their emissions from the accretion disk around, and relativistic jets powered by, a galaxy's central super-massive black hole. We have now obtained a total of eleven quarters of Kepler data on four radio-loud AGN. Our prior work involved calculating power spectral densities (PSDs) on these data both with and without corrections for various instrumental artifacts. We now focus on combining these data sets into one continuous set for each object which spans approximately 2.5 years at a 30 minute sampling rate with >98% duty cycle. The process of stringing together these data is complicated by the quarterly rolls the Kepler space satellite telescope conducts, which causes each target to fall on a different CCD four times per year. We attempt to overcome this problem with a scaling procedure that maintains the original percentage of variations and scales all eleven quarters to the overall average. We calculate PSDs on these stitched light curves both with and without various end-matching techniques applied to increase the accuracy of the PSDs. The PSDs computed for the stitched light curves allow us to probe a full decade lower in frequency than our previous work and show comparable slopes to the PSDs calculated for individual quarters, suggesting we are linking the quarters appropriately. Our average PSD slopes are consistent with ground-based observations of other quasars, falling approximately between -1.6 and -1.9. In addition, we have used original codes to bin and average individual PSDs to reduce the bias introduced on the slope-fitting process induced by the uneven population of points in the PSDs. This allows for a more accurate power-law fitting and tends to steepen the overall slope by approximately 0.1 in the majority of cases. We note increased flaring in one of our objects on the order of 15%, with our remaining three objects being more quiescent with occasional flaring. This work was supported in part by NASA Kepler GO Grant NNX11AB90G and MUSE funds through The College of New Jersey.

Susan L. Knox, Aubrey N. Johnston, and Rajesh Nagarajan
(Danielle Guarracino, Faculty Sponsor)
Synthesis of 2,2'-dimethyldodecanoyl ACP to understand substrate specificity in LasI catalyzed Pseudomonas aeruginosa quorum sensing

Presented at the 247th American Chemical Society National Meeting & Exposition, Dallas, TX, March 16-20, 2014
Bacteria use signal mols. called autoinducers to est. local cell population densities. This mechanism, referred to as quorum sensing, aids bacteria to form biofilms. The LasI AHL (acylated homoserine lactone) synthase enzyme in Pseudomonas aeruginosa uses 3-oxododecanoyl ACP and S-Adenosyl-L-methionine substrates to make 3-oxododecanoyl homoserine lactone autoinducer. To understand the importance of a carbonyl group in C3 position of acyl-ACP substrate in LasI catalyzed AHL synthesis, we decided to compare the catalytic efficiency (k_{cat}/K_m) of 2,2'-dimethyldodecanoyl ACP substrate with 2,2'-dimethyl-3-oxododecanoyl ACP to understand substrate specificity at the 3-oxo position. We used a Meldrum's acid procedure to make the beta-ketoester, dimethylated at C2 position, reduced the carbonyl at C3 via a hydrazone intermediate, and then prepd. acyl-CoA through an N-acyl imidazole intermediate. The final acyl-ACP purifn. will be done using phosphopantetheinyl transfer enzyme. We will use a colorimetric assay to det. the catalytic efficiency of this substrate.

Jennifer Schablik, Joyce Seifried, Manuel Figueroa
(Manuel Figueroa, Faculty Sponsor)
A Biology Module for the Integrative STEM Classroom: Nucleotide Base Colorimetric Detection using Silver Nanoparticles
Presented at the National Association of Biology Teacher (NABT) 2014 Professional Development Conference, Cleveland, OH, November 13-15, 2014.

The purpose of this summer research project was to develop a lesson plan that implements basic concepts of nanoscience into the classroom to make students more aware of possible careers in the STEM discipline. The lesson plan is proposed as a criminal investigation where a forensic scientist develops a way to code for a sample of DNA using nanoparticles through the reduction of silver nitrate with sodium borohydride. Interactions between DNA nucleotide bases (Adenine, Thymine, Cytosine, Guanine, and Uracil) and colloidal silver nanoparticles were investigated through a color change in solution at multiple concentrations (50 mM, 10 mM, 1 mM, 100 μM). This work describes the interaction of silver nanoparticles with DNA nucleotide bases and how these interactions alter the absorption spectrum of visible light, resulting in a visible color change specific to each nucleotide base. A color change is important in the biological sciences as an indicator for molecular interaction. The lesson provides a hands-on investigation and visual representation of the absorption of visible light, a topic emphasized by the Next Generation Science Standards (NGSS). A spectrophotometer was used to record absorption data so students can graph and discuss the nanoparticle absorption of light. The activity was demonstrated in a high school science course in order to measure the effectiveness of the lesson and student understanding. Assessments include a pre and post lesson survey as well as in class discussion.

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