



2009 HCLAS Natural Science Research Symposium

Friday, April 17, 2009

Cultural Center Theater, Axinn Library



Speaker Schedule

8:30 – 9:00 a.m. Gather for Continental breakfast

Session I

9:00 Harold Hastings (Phys) Stability of complex systems in ecology and economics

9:30 Sylvia Silberger (Math) Automorphism groups of finite groups

10:00 Mickey Merguerian (Geol) Redefining the intrusive contact between the Yonkers and Fordham Gneisses in Van Cortlandt Park, NYC

10:30 – 11:00 a.m. Coffee Break

Session II

11:00 Anthony Agnone (Engg) Transient response of a thin foil heat flux gauge – backradiation effect

11:30 Laura Vallier (Bio) The *C. elegans* LIM-7 transcription factor is essential for life

12:00 Jeremy LeWitt (Csc) Wireless sensor networks

12:30 – 1:30 p.m. Lunch: Sandwiches and soda

Session III

1:30 Christina Lacey (Astr) The start-points of massive star formation: Ultra dense HII regions

2:00 Chuck Liang (Csc) A unified system for the structured construction of proofs

2:30 Ray Mulligan (Csc) Coverage problem in wireless sensor networks

3:00 – 3:30 p.m. Coffee Break

Session IV

3:30 Robert Lavoie (Csc) A brief introduction to wireless sensor networks

4:00 Sabrina Sobel (Chem) Spectator ions ARE important! A kinetic study of the copper-aluminum displacement reaction
Skyler Cohen

4:30 Bret Bennington (Geol) Statistical reanalysis of dinosaur trackways at
Christa Abatemarco Dinosaur State Park, CT

5:00 – 5:30 Reception: Wine and cheese

ABSTRACTS

Session I

9:00 Harold Hastings (Phys) Stability of complex systems in ecology and economics

Both ecological and economic systems typically involve interactions among many components, which have traditionally been modeled by difference equations. One major question is "how stable are these systems?" Random matrix models, adapted from physics, have proven very useful in understanding stability of ecosystems. We describe these models and their application to stability of economic systems. Partially supported by the Department of Energy under Award Number DE-FG02-08ER64623 for the Hofstra University Center for Condensed Matter Research.

9:30 Sylvia Silberger (Math) Automorphism groups of finite grupoids

A "groupoid" is a set together with a binary operation on the set; that is, a function that takes two members of the set and produces another member of the set. A "group" is a groupoid with more structure: associativity, identity and inverses. When one studies algebraic structures such as groupoids, it is often useful to consider their "symmetries." These symmetries, or as mathematicians refer to them "automorphisms," are bijective functions from the groupoid to itself that "preserve" the operation. The automorphisms themselves form a group under composition. There are many theorems about what types of groups can themselves be automorphism groups of various algebraic structures (such as groupoids), however there are very few relating the size of the group and the size of the groupoid it might be an automorphism group of. We analyze which groups on n elements are automorphism groups of groupoids on n elements.

10:00 Mickey Merguerian (Geol) Redefining the intrusive contact between the Yonkers and Fordham Gneisses in Van Cortlandt Park, NYC

Following the excavation of tunnels originating within Van Cortlandt Park for the construction of the Croton Water Treatment Plant in Bronx, NY, the contact between the Yonkers Gneiss (Zy) and the Fordham Gneiss (Yf) formations were exposed in the side-wall of tunnel excavations. The particular orientation of tunnel excavations for the project provided a unique opportunity to view the contact at three separated locations along the tunnel alignment, redefining the southern terminus of the Yonkers gneiss intrusive into the Fordham gneiss complex. Based upon observations of the field and petrographic relationships of the rock masses exposed during tunneling operations, the contact of the Yonkers gneiss can be re-drawn to extend farther southward in contact with the Mosholu fault at the southern end of Van Cortlandt Park.

Session II

11:00 Anthony Agnone (Engg) Transient response of a thin foil heat flux gauge – backradiation effect

The transient response of a thin foil heat flux gauge is needed to determine the time for the gauge to achieve a steady state or close to it, and to be able to determine the transient irradiation from the output of the gauge. Here, the transient response of a thin circular foil heat flux gauge is analyzed accounting for back-radiation to determine its effects on the response of the gauge. The governing non-linear heat equation is solved for a constant irradiation flux for all values of the dimensionless gauge parameter and all dimensionless irradiation parameter. Firstly, an asymptotic approximation is used to obtain an analytic solution of the temperature history at the center of the gauge. Secondly, a series solution in powers of the square of the radial coordinate is developed to obtain the dimensionless temperature profile. The dimensionless temperature at the center of the gauge is determined by numerical integration of a non-linear ordinary differential equation. An approximate exponential expression for the dimensionless temperature at the center of the foil which satisfies two initial conditions and approaches the steady state asymptotically is developed. The time constant is found to be dependent on the irradiation and the dimensionless temperature at the center of the gauge besides the thermo-physical and geometric properties of the gauge. For reference, a summary of the steady state solution previously published by this author is presented here in an appendix. Thirdly, the results of the previous two solutions are compared with a numerical solution, using an explicit scheme of the exact non-linear partial differential equation. The present solutions are also compared with previous analyses that do not account for the back radiation.

11:30 Laura Vallier (Bio) The *C. elegans* LIM-7 transcription factor is essential for life

The *C. elegans* LIM-7 transcription factor is a member of the evolutionarily conserved LIM-homeodomain transcription factor family. Its ortholog, ISLET-1, was identified as a protein that bound the rat insulin gene enhancer. In *C. elegans*, *lim-7* mutants die in the first larval stage and have a variety of defects, including uncoordinated movement, detached pharynx, and a constipated intestine, among others. LIM-7 is expressed in many neurons and the gonadal sheath, among other cell types. The first intron of *lim-7* is unusually large and within it a 45-bp element is necessary and sufficient for expression in the gonadal sheath.

12:00 Jeremy LeWitt (Csc) Wireless sensor networks

An overview of wireless sensor networks including applications.

Session III

1:30 Christina Lacey (Astr) The start-points of massive star formation: Ultra dense HII regions

Massive clouds of ionized hydrogen, called HII regions, are the birthplaces and stellar nurseries for stars. In my presentation, I will talk about recent results from a high sensitivity Very Large Array (VLA) radio survey of the nearby galaxy NGC 247 in which two ultra dense HII (UDHII) region candidates were recently identified. The ultra dense HII regions represent the beginning point of stellar evolution and provide astronomers with insight into how massive stars are formed and how, ultimately, the environments of galaxies are modified by massive star formation.

2:00 Chuck Liang (Csc) A unified system for the structured construction of proofs

Proof theory is a branch of mathematical logic that seeks to formalize the deductive arguments used by mathematicians as well as the algorithmic process that underlies the execution of computer programs. In fact proof and program are shown to be equivalent notions under certain settings. I will present my recent work on focused proofs, which seek to structure all proofs in a uniform way. In addition, the various "logics" used in theoretical computer science, including classical, intuitionistic and linear logic, can all be seen as fragments of a unified framework.

2:30 Ray Mulligan (Csc) Coverage problem in wireless sensor networks

Overview of the coverage problem in wireless sensor networks. Definition of the coverage problem, description of the different ways in which the problem can be approached. Summary of existing research.

Session IV

3:30 Robert Lavoie (Csc) A brief introduction to wireless sensor networks

A brief introduction to sensor networks.

**4:00 Sabrina Sobel (Chem) Spectator ions ARE important! A kinetic study of the
Skyler Cohen copper-aluminum displacement reaction**

Spectator ions are responsible for unexpected kinetics in the biphasic copper(II) – aluminum displacement reaction, with rate of reaction dependent on the identity of the spectator ions. Applicability of a published kinetic analysis for reaction of a rotating aluminum disk to the simple aluminum foil reaction is demonstrated. The ‘chloride acceleration effect’ is found to be true for both chloride and bromide, and should be more generally termed a ‘halide acceleration effect’. This interesting and simple reaction can be used to deepen students’ understanding of biphasic processes that are important industrially, *i.e.* aluminum corrosion, and to ‘burst the bubble’ of rigid thinking that spectator ions always can be ignored.

**4:30 Bret Bennington (Geol) Statistical reanalysis of dinosaur trackways at
Christa Abatemarco Dinosaur State Park, CT**

Dinosaur State Park in Rocky Hill, CT, is one of the largest dinosaur trackway sites in North America, exposing more than 500 tracks of Early Jurassic dinosaurs. Although several studies have measured and described the footprints and trackways at the site, no attempt has been made to apply any quantitative statistical analyses to the trackway data. In this talk we present an overview of the DSP site, a new statistical analysis of trackway orientation, and an overview of future work analyzing using statistical analysis to quantify the number of individual dinosaurs responsible for making the preserved tracks.

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