



U N I V E R S I T Y O F
SOUTH CAROLINA

DEPARTMENT OF
PHYSICS AND ASTRONOMY

COLLOQUIUM

Speaker:

Joseph E. Johnson, PhD
Professor, Department of Physics
University of South Carolina

Title:

“Information, Entropy, and Applications”

Abstract:

The Markov transformations (as a continuous group) leave the sum of the components of a vector invariant but when restricted to maintaining the non-negativity of the components, one loses the inverse and the Markov group becomes a ‘monoid,’ a group without the inverse. Thus the Markov group and monoid are applicable to fields as diverse as probability theory, diffusion theory, and population dynamics. With the Abelian group that scales the coordinates, one obtains the group of all possible linear transformations. It is the diffusion process associated with the Markov monoid that gives insight into the loss of (Shannon & Renyi’) information and the increase of entropy and which mandates irreversible flow of time in physical processes.

We will discuss our progress in applying these ideas to several areas: specifically to the (a) analysis of networks based upon our theorem that every possible network is isomorphic to the Lie algebra of the Markov monoid as well as to demonstrate the information spectral decomposition of any network; (b) a generalization of the real numbers that encompasses numerical uncertainty along with a generalization of Boolean logic to full logical uncertainty and the loss of information in numerical processes (akin to the loss of useful work under nonconservative forces in mechanics); (c) the possibility (and difficulties) of describing quantum states with these generalized numbers (and their connection to wavelets). These generalized numbers are shown to be Markov group (monoid) representations.

During the colloquium we will pass out 25 IPOD Touch WiFi devices to ‘volunteers’ and demonstrate our ‘beta’ QRECT software that allows an instructor to collect general responses from a class in real time and to instantly grade the results. We will discuss the use of our self-correcting algorithm for expert consensus whereby the computer algorithm uses a Shannon information function to estimate the correct answer to unambiguous unique single string (or numerical) responses that are not too difficult for the collective class. When completed, the software will automatically: (a) take attendance showing student seat numbers, (b) collect and grade homework, (c) allow questions to be asked and then grade responses, (d) administer exams and quizzes, (e) do polling, (f) collect demographic information – and then email the results to the student (and parent?) at the end of class with the resulting grade awarded.

Jones Physical Science Center
Rogers Room
PSC 409

Thursday, December 6, 2007
3:30 pm

Refreshments at 3:15 pm

Everyone invited

Hosted by:
Sanjib Mishra