State of STEM Conference, April 26, 2012

Theme: Broadening Participation in STEM Disciplines
Presented by the UCF ICubed project

Fairwinds, Alumni Center
University of Central Florida
Thursday, April 26, 2012

Conference Agenda:

9.00-9.10 a.m.
Opening Remarks
Tony Waldrop, Provost
University of Central Florida

9.10-10.10 a.m.
From Computer Science to Story-Telling and Back
Christos Papadimitriou, National Academy of Arts & Sciences
University of California, Berkeley

10.10-10.40 a.m.
EXCELing and Broadening Participation in STEM Disciplines
Michael Georgiopoulos, Pegasus Professor
University of Central Florida

10.50-11.20 a.m.
Promoting STEM Education and Embracing Creativity
Bobby Jeanpierre, Associate Director Lockheed Martin Mathematics and Science Academy
University of Central Florida

11.20-12.20 p.m.
Creativite Sans Frontieres
Harry Kroto, 1996 Nobel Laureate in Chemistry
Florida State University

12.30-1:00 Free Lunch for morning session attendees

1:00-1.30 p.m.
Book and picture signing
C. Papadimitriou & H. Kroto

1:00-2.30 p.m.
STEAM Poster Showcase

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Christos H. Papadimitriou's Short Bio:

Christos Papadimitriou is the C. Lester Hogan professor of Computer Science at the University of California at Berkeley.

Before Berkeley, he taught at Harvard, MIT, and Stanford. His research is on the mathematical theory of algorithms and complexity, and the applications of this theory to various fields such as: optimization, databases, control theory, robotics, artificial intelligence, the internet and the worldwide web, mathematical economics and game theory, and the theory of evolution. His more than 300 papers and books have been cited more than 40,000 times. He is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the National Academy of Engineering. He plays keyboards with the Berkeley-based rock band "The Positive Eigenvalues" and has written three novels, of which the second was on the New York Times bestseller list for fifteen weeks.

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Christos H. Papadimitriou's Presentation Specifics: From Computer Science to Storytelling and Back

Stories and logical arguments are the two fundamental, and seemingly mutually exclusive, categories of thought. Among the two, stories are, in many ways, closest to our humanity. Our brains are made to long for stories, not for logic (or for talk abstracts, incidentally).

In the primordial village, where we have spent much of our existence, all information (the tribe's laws and beliefs for example, and all kinds of practical knowledge) was transmitted through stories. And yet, it was reasoning and logic that have led us to some of our most brilliant and consequential achievements, such as quantum mechanics and the internet. This talk treads the uncomfortable and sparsely inhabited territories where the two meet: stories about science, and the science of stories.

It revolves about two questions:

First, what is the prehistory of the computer and the internet?

What were the ancient intellectual currents which eventually culminated in this technology? I claim that one of the three main ones (I will let you guess the other two) is Logic, the brainchild of Aristotle eventually taken up by Leibniz and Boole, then adapted by Frege to the pursuit of the foundations of mathematics, a project advanced by Hilbert and Russell but ultimately slain by Gödel, only to bring about --- through an improbable and fascinating intellectual Rube Goldberg --- the computer and the internet via the work of Turing and von Neumann. Incidentally, the graphic novel "Logicomix" tells precisely the tale of this quest, a story of immense intellectual courage and personal tragedy, which unfolded in Europe during the dark first decades of the last century. The other question we shall pursue is, can there be a meaningful connection between two of my favorite intellectual activities, namely storytelling and computer programming?

I shall argue that indeed there are ample parallels between the two, and you shall be the judges.

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Harry Kroto's Short Bio:

Sir Harold (Harry) Kroto is currently a Francis Eppes professor of Chemistry at Florida State University, where he is carrying out research in nanoscience and cluster chemistry as well as developing exciting new Internet approaches to STEM educational outreach. In 1996 he was knighted for his contributions to chemistry and later that year was one of three recipients of the Nobel Prize for Chemistry in 1996. He is a Fellow of the Royal Society of London, and holds an emeritus professorship at the University of Sussex in Brighton, United Kingdom. The research program focuses on the complex range of molecular constituents in carbon vapour; the development of novel 2 and 3D metal-cluster/organic frameworks as well as peptides; the stabilization of small fullerenes; and carbon nanotube based devices behaviour.

Harry obtained a first class BSc honours degree in Chemistry (1961) and a PhD, in molecular spectroscopy in 1964 at the University of Sheffield (UK). After post-doctoral positions at the National Research Council in Ottawa, Canada (1964-66) and at the Murray Hill Bell Laboratories (NJ, US) in 1966-67 he started his independent academic career at the University of Sussex. In 1970 his research group conducted laboratory spectroscopic studies on long linear carbon chain molecules with colleague David Walton. This research led to radio astronomy searches with Takeshi Oka and Canadian astronomers (Lorne Avery, Norman Broten and John McLeod) at the National Research Council in Canada which made the surprising discovery that they existed in unusually copious amounts in certain regions of interstellar space. At the same time he developed flash thermolytic synthetic methods to create new metastable species and intermediates with multiple bonds between carbon and second and third row atoms (S, Se and P) and applied microwave spectroscopic techniques to detect and characterise them. The work on multiply bond carbon-phosphorus species (with Sussex colleague John Nixon) created the first molecule with a C=P double bond and the second with a C≡P triple bonded species. The general synthetic techniques developed opened up the exciting new fields of Phosphaalkene and Phospahalkyne Chemistry. Conclusions derived from the earlier radioastronomy breakthrough on carbon species in space led to experiments in 1985 together with Robert Curl, Richard Smalley and research students Jim Heath, Sean O'Brien and Yuan Liu at Rice University (Texas). These laboratory experiments which simulated the chemical reactions in the atmospheres of red giant stars uncovered the existence C_{60} Buckminsterfullerene, the third well characterised form of carbon, for which he together with Curl and Smalley received the 1996 Nobel Prize in Chemistry.

In 1995, he launched the Vega Science Trust (www.vega.org.uk) to create science films of sufficiently high quality for broadcast on UK network television. He is now heavily involved with GEOSET a Global Educational Outreach for Science, Engineering, and Technology programme (www.geoset.info and www.geoset.fsu.edu) which he initiated after moving to Florida State University. GEOSET seeks to exploit the revolutionary creative dynamics the Internet (which Harry calls it the GooYouWiki-World) to improve the general level of science understanding an awareness worldwide. Numerous universities in the US, UK, Japan, Croatia and Spain are now contributing to GEOSET's rapidly growing, globally accessible freely available cache of science educational material in modular form designed to help teachers. A most exciting aspect of this initiative has been the revelation that graduate and undergraduate students are often exceptionally good at creating educational modules.

He has numerous awards including the Copley Medal, Faraday Lectureship of the Royal Society as well as the Tilden Lectureship and Longstaff Medal of the Royal Society of Chemistry. Other awards include the Louis Vuitton – Moet Hennessy Science pour l'Art prize and the Italgas Prize for Innovation. He holds some 36 honorary degrees from universities all over the world and is a Freeman of the City of Torino. From 2004 he has been on the Board of Scientific Governors at Scripps Institute. He was elected a Foreign Associate of the National Academy of Sciences in 2007.

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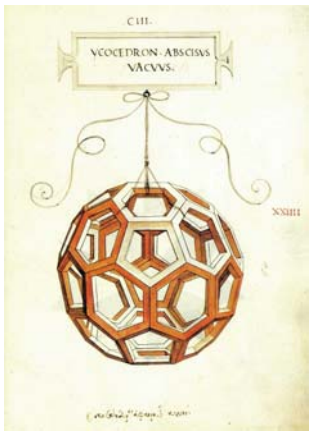
Harry Kroto's Presentation Specifics: Creativite Sans Frontiers



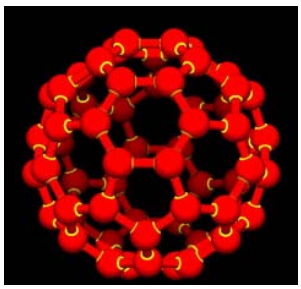


Fig 3 from http://pics.twobrained.com/132/free-photo-of-science-world-geodesic-dome-structure/

Créativité Sans Frontières

Harold Kroto, Florida State University

Children are not the only ones who instinctively appreciate the elegant beauty of highly symmetric structures such as the soccer ball (Fig 1) and "play" with them. Artists, architects, scientists, mathematicians and engineers are also fascinated by elegant structures and use them in their creative efforts. Leonardo da Vinci drew the magnificent image (Fig 2) and Buckminster Fuller designed geodesic domes such as that in Fig 3. When C_{60} Buckminsterfullerene was discovered it was its elegant symmetry that captured the imagination of scientists and non-scientists alike. More subtle yet no less cathartic responses are engendered in the minds of people who possess the fluency to appreciate not only the beauty of mathematical symbols but also the intricate elegance of their operations as well as their value in applications (Fig 5).

Fig 5: *Nicole, a physics grad student writes: My tattoo is the Taylor expansion of sine. I consider it the most beautiful thing I have ever learned. I got the tattoo after my freshman year at MIT. It has additional meaning to me since sin(x)~x is one of the most useful things in physics.*

Indeed mathematics, in particular symbolic algebra, is arguably our most treasured intellectual creation, as mankind finally realised that it was the language in which the Universe speaks and reveals its deepest and most spiritually moving secrets.

The presentation will explore some of the common aspects of the creative response - *sans frontières* - from an appreciation of the forms discovered by scientists and readily appreciated visually to the mathematical forms created by humans as well as the elegant creations of artists through which they explore the human condition.

However something new has just entered the equation – the Internet – and it is arguable that it has catalysed more human creativity than any invention since the printing press as individuals are now able to broadcast on every topic imaginable and in particular use the GooYouWiki World to help to improve education globally.

It is a fascinating and thought-provoking fact that it is the appreciation of patterns both simple and complex that abound in the physical and natural world as well as in mankind's symbolic and artistic creations that, when combined with human curiosity, have driven advances in understanding at every level and changed every aspect of the modern world.