Research Students Expo 2012: Program

11:00 - Galven Lee: Why the Charismatic movement in Singapore: "An inconvenient truth, an inexpressible gift?

No abstract.

11:15 - Louis Klee: Russian Identity in the Wake of the Crimean War

No abstract.

11:30 - Richard Skelton: A high pressure work environment: tilting in mantle perovskites

The lower mantle is a layer in the Earth's interior that extends from the bottom of the transition zone–660 km depth–to the core-mantle boundary, at a depth of 2886 km, and is dominated by perovskite minerals. The perovskite structure–a common structure for minerals with the composition ABO_3–consists, in the ideal case of cubic symmetry, of a three-dimensional network of corner connected BO_6 octahedra, with A cations occupying the 12-fold coordinated sites between the them. Many distortions from this maximum symmetry structure are possible, of which the most important in geological contexts is tilting of the BO_6 octahedra about the crystal axes. In this talk, I will present recent density functional theory calculations on silicate perovskite minerals (with A = Mg, Ca), aimed at constraining the relative importance of octahedral tilting and compression in perovskite minerals at lower mantle pressures.

11:45 - BREAK

12:00 - Yale Wong: Transit-Conducive Urban Design

The effects of private motor vehicle use on congestion and pollution are well documented, with severe impacts for health, energy security and climate change. Given that the battle for sustainability will be fought and won in cities, the challenge for jurisdictions around the world is to reduce automobile dependence and shift commuters onto mass transit. This presentation explores a critical determinant of the success of such measure- urban spatial structure. Drawing on a literature review conducted using the meta-analysis approach, questions relating to the transit implications of density, diversity and design seek to be addressed. Understanding transit-conducive urban design can better inform planning and policy, moving our cities towards sustainability to enrich our communities and our lives.

12:15 - Samantha Lambe: Transport and metabolism of TCA-cycle intermediates in *Plasmodium falciparum*

Malaria affects over 200 million people globally every year with estimates at over 1 million deaths annually. The disease itself is caused by parasites, the most common being *Plasmodium falciparum*, carried by mosquitos. With the area in which the parasite is found increasing and drug resistance on the rise it is important for world health that the metabolism of the parasite is understood so that targeted drugs can be found. Until recently it was thought that the parasites lacked a functional TCA cycle but it was recently hypothesized that the parasite may instead have a branched TCA pathway beginning with α-ketoglutarate (αKG) and ending with the formation of malate. In this project transport of αKG was investigated using radiolabelled αKG. It was found that αKG uptake into the cell occurred rapidly and linearly and resulted in an increase of radiolabel in protein indicating that the αKG is being converted to amino acids. Competitive uptake was also investigated and it was found that increasing concentrations of malate inhibited the uptake of radiolabelled αKG to an extent. This indicated that malate and αKG may share a mode of transport into the cell. Glutamate competition was also investigated but no competition was found, however, the results indicate that there may be other factors affecting these cells.

12:30 - Jonathan Chua Yi: Craig's Genealogy of Knowledge: Towards a 'How-Actually' Evolutionary Explanation

In *Knowledge and the State of Nature*, Edward Craig introduces a genealogical account of knowledge. The genealogy is a hypothetical history of the process giving rise to our modern intuitions regarding knowledge, truth and belief, taking place in a hypothetical state of nature. Craig envisages an imaginary community containing humans whose cognitive abilities are no different from our own, and who co-operate to meet survival needs. It is in this community that an ancestral concept of knowledge is developed. The genealogical narrative must explain how this so called "protoknowledge" was eventually replaced by our modern concept. I will attempt to place Craig's narrative in the context of human evolution, which he neglects with the assumption that our cognitive abilities may be held constant throughout the hypothetical prehistory. This is known as the Constancy Assumption. However, since empirical evidence suggests that human evolution did take place concurrently with the development of knowledge, this is not a justified assumption to make. I will reject the Constancy Assumption and substantiate Craig's imaginary genealogy by integrating it with an empirical account that explains human cognitive evolution. This empirical grounding provides the conditions for a transition towards a "how-actually" evolutionary account of knowledge.

1:00 - LUNCH

2:00 - Rebecca Davies: The Starburst-AGN Connection: Optical Diagnostics in NGC7130

Composite galaxies are defined as galaxies whose emission is characteristic of a combination of star formation and higher energy ionising radiation. Astronomers have several hypotheses regarding the power sources of composite objects, with starburst-shock, starburst-AGN and old starbursts accepted as likely scenarios. However, lack of observational data means that the nature of composite galaxies is not well-restrained, and thus it is not known whether this is a well-defined class of objects. Study of composite objects has been hindered by complications associated with resolving individual emission signatures and kinematics from single aperture spectra. However, Integral Field Spectroscopy has solved this problem, allowing spatially resolved emission line information to be gained for several hundred pixels in one pointing. In this talk I will present optical Integral Field Spectroscopic data for NGC7130. This galaxy hosts both an actively accreting supermassive black hole and an adjacent fierce starburst episode – which makes it a prime object to investigate as a possible starburst-AGN composite. We have shown that this galaxy has a clear starburst-AGN mixing region, and that there is a definite relationship between the average strength of ionising radiation and distance from the nuclear region. This clearly points to NGC7130 as a starburst-AGN composite.

2:15 - Sherman Tan: The Semiotic Circulation of 'Cuteness' as Cultural, Sensual and Aesthetic Form

Cultures of cuteness constitute richly textured (text-tured) and aestheticized sites for the analysis of material culture and consumption in contemporary societies. In my presentation, I engage with the existing literature on the cute-kitsch: its multilayered formations, its intersections with a multitude of other sociocultural discourses, as well as its complex ideological effects on subjectivity and the production of a specific modern sensual and aesthetic condition of sociality. By treating 'cuteness' as a simultaneously empty and over-determined signifier, and as a carrier of potentially contradictory social meanings, I demonstrate that various cultures of cuteness - including (but not limited to) popular manifestations of consumerist complexes such as 'Hello Kitty', 'The Powerpuff Girls', and the yellow 'Minions' in the movie 'Despicable Me' - can be understood as amalgamations and/or networks of meaning (indexical/representational orders) that are both subject to and reliant upon semiotic processes of mediation. To this extent, I explain how the concepts of 'sensational form' (Birgit Meyer), 'semiotic ideology' (Webb Keane), 'commodity register' (Asif Agha), 'metaculture' (Greg Urban), and the 'politics of immediation' (William Mazzarella) can elucidate and clarify 'cuteness' as a constellation/sedimentation of sociocultural meaning. I conclude by means of thinking about cultures of cuteness as polyphonic or dialogic discourses constituted by a multitude of social voices (Mikhail Bakhtin) and its implications for the analysis of forms of cuteness.

2:30 - Daniel Filan: The Higgs Story: the physics of elementary particles and why we think there's a Higgs Boson

On the 4th of July this year, the world's media exploded with reports of the discovery of the Higgs boson at the Large Hadron Collider (LHC). Yet how many of us understand what exactly the Higgs boson is, or why its discovery is important? In my ASC this semester, I studied the theoretical and mathematical foundations of the Standard Model of particle physics, which predicts the existence of such a boson, and how the experiments at the LHC functioned. I will describe, in an accessible way, the basics of the Standard Model and the role that the Higgs boson plays. I will also explain the operation of the experiments at the LHC that gave us the evidence of the Higgs' existence. Finally, I will discuss the importance of this discovery, and why it paves the way for a new era in the theoretical underpinnings of particle physics.

2:45 - Vincent Aw: Mathematical Formulations of the Monoprotic Titration Curve

The titration curve is a characteristic sigmoidal graph- a natural phenomenon that occurs frequently in aqueous chemistry. Many people are familiar with its form, but less familiar with the mathematical formulation of titration curves. Mathematical functions for the titration curve have been derived in the past, but are either empirical polynomial functions which do not give quantitative accuracy, or derived based on rearranging and substituting existing formulae (Aw & Jeng, 2012). We have discovered an original derivation for a set of mathematical functions which describes the monoprotic titration curve with quantitative accuracy. Our functions are unique as our derivation is based on aqueous equilibria principles and processes that occur during the titration- an original approach to mathematical formulation of the titration curve. Comparison shows an accurate match between theoretical and experimental curves, leading to the conclusion that our functions are plausible and work well.

3:00 - Stephanie Wright: A Matter for Re-Dress? Imagining the Veil in Islam and the West

Does the veil objectify Muslim women? Or does it enable them to escape objectification by withdrawing them from the superficial culture of beauty and sex in the West? These and similar questions have echoed throughout the Western debates on the veil over the past ten years. Rather than asking what the veil is or does, this presentation seeks to look at the ways in which the symbolism of the veil has been adopted, adapted, and misappropriated in diverse historical contexts and regions, with a focus on Iran and Egypt. By exploring the historical origins and evolutions of veiling, it challenges some of the most basic assumptions of Western discourses. It also demonstrates the pivotal role of the West, through colonial and cultural invasions into Islamic cultures, in determining the evolution of the debate on veiling in Islam. Instead of assuming a fixed and objective symbolism, my presentation will explore the diversity and fluidity of discourses on the veil in reference to the various historical circumstances that have produced them. By focusing on the politics of selective representation, this presentation asks not what is the meaning of the veil, but what has motivated cultures and individuals to represent the veil as they have done throughout history and today.

3:15 - Yong-Shen Han: A computational analysis of donor-spacer-acceptor complexes

Chemists are inherently interested in bonding. By understanding the nature and strength of chemical bonds we can predict what compounds can be formed. "Donor-Acceptor" compounds, such as NH_3-BH_3, are well known, in which a donor species contributes all of the electrons to form a co-ordinate covalent bond with an acceptor. However, the recent experimental discovery of Xe-C_6F_4-BF_3 suggests that a new class of bonding is possible. In this class, the relatively inert noble gas Xe is able to act as donor with a BF_3 acceptor with the C_6F_4 species acting as a spacer between the two. The corresponding donor-acceptor complex Xe-BF_3 is weakly bound in comparison, suggesting that the interaction with the spacer facilitates or even enhances bonding. Various complexes of the type "donor-spacer-acceptor" were investigated computationally. The results will be presented with the goal of providing some insight into what makes a favourable donor-spacer-acceptor interaction.

3:30 - Amitesh Datta: An Introduction to Graph Theory

Graph theory, as its name suggests, is the branch of mathematics in which one studies the properties of graphs. A graph consists of a set of vertices and a set of edges where an edge is an (unordered) pair of vertices; if an edge is a pair (v,w) where v and w are vertices, then we intuitively think of the edge as joining the vertices v and w. In my talk, I will discuss the definition and basic properties of graphs with an emphasis on intuition and visualisation (we will draw many graphs). A reason that graph theory is beautiful is that one can pose many interesting questions, which are easy to state and understand, but not easy to answer.