Oct 2016 Complexity Community Sharing Session

4 Oct 2016 (Tue) 11:00am-01:00pm

Seminar Room 102

(opposite Learning Hub), Blk 1 Innovation Centre, Level 1
16 Nanyang Drive, Singapore 637722

Dr. Gordon WOO

Dr. NI Ran

Counterfactual Modelling

Since Galileo, we know that the Earth is not the centre of the universe. But the anthropocentric view persists that the historical past is somehow special, rather than 'just one of an infinitude of pasts, all equal valid', which was the view of the French writer André Maurois, and would be echoed by those trained in physics. How the past is viewed is crucial for disaster risk analysis because of the sparsity of extreme events. There is insufficient experience data to predict confidently the frequency of such rare events. Furthermore, human counterfactual reasoning is prone to outcome bias: people think more about how events might have been better than how they might have turned for the worse.

Historical determinism is inconsistent with modern complexity science. Moving away from a deterministic view of history, stochastic modelling of the past is needed to explore not just what happened, but also what nearly happened and what might have happened. Scenarios are counterfactual histories of the future. The more stochastic modelling of the past that is undertaken, the fewer surprises there will be in the future. This is demonstrated with models used to illustrate the principles, and important practical examples drawn globally from disasters of all kinds.

Biography: *Dr. Gordon Woo is a catastrophist at Risk Management Solutions (RMS) specializing in the assessment and management of extreme risks. He is the author of the two books, 'The Mathematics of Natural Catastrophes', published by Imperial College Press in 1999, and 'Calculating Catastrophe', published by Imperial College Press for the tenth anniversary of 9/11. Both books were printed by World Scientific in Singapore.*

Dr. Woo graduated as the best mathematician of his year at Cambridge University, completed his PhD at MIT as a Kennedy Scholar, and was a member of the Harvard Society of Fellows. He is an adjunct professor at the NTU Institute of Catastrophe Risk Management, as well as a visiting professor at University College London. His current research on counterfactual modelling combines his academic interests in physics, psychology and catastrophe science.

Tunable Long Range Forces Mediated by Self-Propelled Colloidal Hard Spheres

Most colloidal interactions can be tuned by changing properties of the medium. Here we show that activating the colloidal particles with random self-propulsion can induce giant effective interactions between large objects immersed in such a suspension. By performing Brownian dynamics simulations, we systematically study the effective force between two hard walls in a 2D suspension of self-propelled (active)colloidal hard spheres. We find that at relatively high densities, the active colloidal hard spheres can form a dynamic crystalline bridge, which induces a strong oscillating long range dynamic wetting repulsion between the walls. With decreasing the density of active colloids, the dynamic bridge gradually breaks, and an intriguing long range dynamic depletion attraction starts dominating the effective interaction between the two walls. The two long range forces oppose each other, and the effective interaction can be tuned from a long range repulsion into a long range attraction by reducing the density of active particles. Our results open up new possibilities to manipulate the motion and assembly of microscopic objects by using active matter.

Biography: *Dr. Ni got his B.S. (Computational Mathematics, 2005), M.S. (Chemical Engrg, 2008) from Beijing University of Chemical Technology, and Ph.D. (Physics, 2012) from Utrecht University. His awards in China includes the Cup of Higher Education Press (Champion) in National Wide Mathematical Contest in Modeling, First Prize in National Postgraduates Mathematical Contest in Modeling and Chinese Government Award for Outstanding Self-financed Students Abroad.*

2012 - 2014: research fellow in a joint program between University of Amsterdam & Wageningen University.
2014: NWO VENI fellowship, the most prestigious personal grant for young scientists.
2016: Asst. Professor School of Chemical & Biomedical Engrg, NTU

HIs research covers self-assembly of colloidal & (bio) polymeric systems in and out of equilibrium. His recent work on active colloids showing active matter can be used to control glass transition & crystallization of colloidal suspensions as well as to generate long rang interactions to direct the organization of passive matter, was awarded the Best Research Prize 2015 by European Cooperation in Science & Technology Action – Flowing Matter, a prestigious annual prize for European Early Stage Scientists in soft matter within 8 years of PhD.

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