# USC Summer Academy on Non-Perturbative Physics

A first of its kind three-week graduate student summer school on "Dyson-Schwinger Equations (DSEs) to tackle non-perturbative physics, their applications in Quantum Chromodynamics (QCD) and condensed matter physics, and their mathematical connection to the Hopf algebras" will be held at USC from July 26 to August 10, directly preceding a three-day international workshop on "Nucleon Resonance Structure in Exclusive Electroproduction at High Photon Virtualities". There are a limited number of slots for outside graduate students available. If you would like to come or send a graduate student please contact gothe@sc.edu or webb@sc.edu.

Karen Yeats: "The Hopf Algebraic Approach to DSEs". DSEs are very useful in how they mirror the recursive decomposition of Feynman diagrams into subdiagrams. This simple combinatorial observation is surprisingly powerful as it gives us hints as to how to unwind the combinatorial difficulties from the analytic ones. Furthermore, the Slavnov-Taylor identities for the coupling constants correspond to certain Hopf ideals. The lectures will explain these connections without expecting prior algebraic experience.

Piers Coleman: "DSE Applications in Condensed Matter Physics". In his lectures, he explains the relevance of DSEs for condensed matter physics and will give a short introduction to interacting electron systems followed by five lectures on: "Feynman diagrams in many body physics", "The interacting electron plasma", "BCS theory I and II", and "The Kondo effect and heavy Fermions".

Craig Roberts: "The Emergence of DSEs in Real-World QCD". The properties of QCD are dominated by two emergent phenomena: confinement and dynamical chiral symmetry breaking (DCSB). These phenomena are not apparent in the formulae that define QCD, and DSEs play a critical role in exploring them and in predicting Nature's observable phenomena in the world of strong interactions.

Ian Cloet: "Hadron Phenomenology and QCD's DSEs". An understanding of how the colored quarks and gluons bind together to form the observed color singlet hadrons remains one of the most important questions in all of nuclear physics. His lectures will explore the interplay between experiment and theory using the DSEs and provide a perspective on answering key questions concerning QCD's nonperturbative structure.