Nicholas Evans

Holographic QCD - Why does it work? What's it good for?

Abstract: Top down holographic models of QCD appear quite baroque with many degrees of freedom beyond QCD yet they provide a sensible looking description of the light mesons. AdS/QCD is an extremely simple encapsulation of the success. I will argue that the reason these models work is that they input a guess for the running of the anomalous dimension of the quark anti-quark bilinear and then predict the spectrum. The baroqueness of the background is largely "integrated out" of the model if the running is sensible! With this insight one can proceed to make qualitative computations of trends in the mesonic spectrum as the running of the anomalous dimension is changed - this has allowed the study of arbitrary Nf and Nc dependent gauge dynamics including walking and the conformal window in the model of Kiritsis and Jarvinen and with Dynamic AdS/QCD. These results provide insight to lattice gauge theorist studying these models. The deep IR runnings in the models control the rate of the decoupling of quark flavours and the n scaling of excited states and are least well understood - I discuss these issues which are related to how stringy the AdS description of QCD should be and the success of holographic pomerons.

Konstantin Zarembo

Localization at large N and holography

Abstract: Path integral in N=2 supersymmetric gauge theories can be calculated exactly, resulting in an effective 0D matrix model. By solving this matrix model at large-N one can access the strong-coupling regime and therefore confront ab initio field-theory calculations with the predictions of holographic duality. I will show how this works for N=2* theory, a massive deformation of N=4 super-Yang-Mills. This model has unexpectedly rich phase structure, with infinitely many quantum phase transitions accumulating towards strong coupling.

Thomas Cohen

Exotics and Universality in QCD(AS)

Abstract: This talk reviews work on hadrons with exotic quantum numbers in the variant of large Nc QCD with quarks in the two index anti-symmetric representation. It is shown that such hadrons including tetraquarks, hexaquarks etc. must exist as narrow hadrons in the large Nc limit of QCD(AS). It is also shown that the Nc scaling of coupling of all types of baryon-number-hadrons is universal.

Mikhail Shifman

Non-Abelian strings: Large–N solution of the world-sheet theories

Abstract: I review non-Abelian vortices which were discovered in 2003 as topological solitons supported in certain 4D Yang-Mills theories. Their distinctive feature is the occurrence of non-trivial world sheet theories, with a varying degree of supersymmetry. Large–N solutions of the above 2D theories exhibit rich and interesting dynamics.

Dmitri Kharzeev

The chiral magnetic effect: from quark-gluon plasma to Dirac semimetals

Abstract: Chirality ("handedness") is an ubiquitous concept in modern science, from particle physics to biology. Recently it has been realized that chirality has dramatic implications for the macroscopic behavior of systems with chiral particles.
In particular, the imbalance between the densities of left- and right-handed fermions in the presence of magnetic field induces the non-dissipative transport of electric charge ("the Chiral Magnetic Effect", CME) analogous to superconductivity. In quark-gluon plasma, this leads to the charge asymmetry studied in the experiments at Relativistic Heavy Ion Collider and the Large Hadron Collider.
Chirality defines the unique properties of recently discovered Dirac semimetals. I will report the observation of CME in a Dirac semimetal ZrTe5, and discuss the future studies of this effect in condensed matter and nuclear physics.

Laurence Yaffe

Large N limits: old questions and new puzzles

Abstract: The effects of fundamental representation fermions are subdominant in the large N limit of non-Abelian gauge theories. Nevertheless, aspects of the matter field dynamics, such as the presence of a fermion number chemical potential, can have a profound influence on the phase structure and symmetry realization of a theory. Various questions and puzzles related to this dichotomy will be discussed: when, and for what observables, is the quenched approximation valid in the large N limit? What is the domain of validity of large N equivalences relating QCD-like theories with isospin chemical potentials to theories with a baryon chemical potential? Do large N equivalences relating theories with different gauge groups have useful implications for baryons?