Black Holes and Applied Holography

Monday 12 November 2012 - Friday 16 November 2012

Scientific Programme

Abstracts of the lecture series:

Series A: Introduction to AdS/CFT (Gordon Semenoff)

This series of lectures will begin with a broad introduction to AdS/CFT holography, with a focus on applications of the duality to study strongly coupled dynamical systems. It will review and discuss the motivation for the original conjectures about dualities between gauge field theories and string theories. The duality between maximally supersymmetric Yang-Mills theory and IIB string theory on an anti-de Sitter background space-time will be reviewed. Modifications of this duality which are needed to model more realistic physical systems in various environments will be developed. This includes introducing temperature, charge density and other thermodynamic features, as well as varying the field content on the quantum field theory side of the duality. A review of some of the simpler applications to 2 dimensional condensed matter systems will be presented.

Series B: Holographic thermalization in field theories (Ben Craps)

Applications of the AdS/CFT correspondence to particle and condensed matter physics have been a subject of intense research for a number of years now. A recent development in this area is the study of non-equilibrium processes in strongly coupled field theories, in particular the approach of thermal equilibrium starting from far-from-equilibrium initial conditions. In these lectures, I will motivate and discuss several holographic probes that can be used to quantify how a field theory thermalizes as a function of time. I will illustrate these techniques in a simple model in which energy injection in a strongly coupled field theory is modeled by a shell of null dust falling into anti-de Sitter space.

Series C: Black Holes in String Theory (Jan de Boer)

Some basic properties of black holes and their construction in string theory will be reviewed. Our present understanding of the microscopic degrees of freedom will be discussed, and time permitting a recent controversy whether or not black holes have so-called firewalls will be used to illustrate how much we still don't fully understand.