

# School on the AdS/CMT correspondence

## Proposal to the ICTP-SAIFR

**Organizers:** Prof. Sean Hartnoll (Physics Dept., Stanford University, USA), Prof. Horatiu Nastase (IFT, UNESP, Brazil), Prof. Diego Trancanelli (IF, USP, Brazil)

**The subject area:** Over the last decade, the AdS/CFT correspondence, originally devised (by Juan Maldacena, in 1997) in order to use string theory methods to solve difficult problems in nonperturbative gauge theories like QCD, has been extended for applications to strongly coupled problems in condensed matter theory. This area, which now goes under the name of AdS/CMT, has gained an enormous amount of interest, leading to a meeting of the two a priori separate fields of string theory and condensed matter theory. As a result, many leading string theorists have become actively involved in condensed matter research, as well as leading condensed matter theorists have been using string theory methods. There is therefore a large need to teach the methods of AdS/CMT, since traditionally students study either string theory or condensed matter, but there is little interaction between the two.

**The school:** We propose to have a two-week school, with 6 lecturers, 3 for each week, each lecturer giving 5 lectures of 1.5 hours each. There would be 3 lectures per day, followed in the afternoon by a problem-solving session, in which the day's lecturers would be available to help out the students solve the assigned problems. The lecturers would be leading researchers in various aspects of the AdS/CMT correspondence. In the first week, we would have more introductory material, one lecturer focusing on condensed matter issues, one on general relativity issues, and one on an introduction to AdS/CMT. In the second week, more specialized topics would be taught, in particular numerical general relativity methods for AdS/CMT, entanglement entropy, holographic transport.

**Preferred time period:** Not yet defined, to be fixed having in mind the availability of speakers. Probably middle of the first semester of 2017, i.e. March-April.

**The preferred list of speakers is:**

*Week one:*

-Prof. Subir Sachdev (Harvard University, USA): Condensed matter problems for AdS/CMT; to be confirmed.

-Prof. Gary Horowitz (University of California at Santa Barbara, USA): General Relativity applied for AdS/CMT; to be confirmed

-Prof. Sean Hartnoll (Stanford University, USA): Introduction to AdS/CMT; confirmed speaker.

*Week two:*

-Prof. Hong Liu (CTP, MIT, USA): holographic entanglement entropy, etc.; to be confirmed

-Prof. Jorge Santos (DAMTP, University of Cambridge, UK): numerical general relativity applications to AdS/CMT; to be confirmed

-Prof. David Tong (DAMTP, University of Cambridge, UK): transport/solitons/anyons in AdS/CMT; to be confirmed

#### **Back-up list for lecturers:**

-Prof. Steve Kivelson (Stanford University, USA): Condensed matter problems for AdS/CMT

-Prof. Sri Raghunathan (Stanford University, USA): Transport in AdS/CMT (condensed matter perspective)

-Prof. Oscar Dias (University of Southampton, UK): General relativity/numerical applications to AdS/CMT

-Dr. Benson Way (DAMTP, University of Cambridge, UK): numerical general relativity applications to AdS/CMT

-Prof. Diego Hofman (ITP, University of Amsterdam, Netherlands): holographic fermions/entanglement entropy

-Prof. Aristomenis Donos (CPT, Durham University, UK): holographic transport/horizons.