XXVIII THEP SERC SCHOOL, IIT KANPUR
NOV 11 - 30, 2013

• **Introduction to Supersymmetry :**

Syllabus : Susy algebra. Representations of susy. Superspace and superfields. Chiral and vector superfields. Wess-Zumino model. Moluli space of vacua. Susy breaking : ORaifeartaigh model. Lagrangians of susy gauge theories : abelian and non-abelian. Coupling to matter. Fayet-Iliopoulos mechanism.

Prerequisites : Group theory and QFT at the level of the Prep School.

References :

- H. Baer and X. Tata, Weak scale supersymmetry, Cambridge Univ. Press (2006).
- M. Drees, R. Godbole and P. Roy, Theory and phenomenology of sparticles, World Scientic (2004).
- P. C. West, Introduction to supersymmetry and supergravity, World Scien- tic (1989).
- J. Wess and J. Bagger, Supersymmetry and Supergravity, Princeton Univ. Press (1992).
- R.K. Kaul, Supersymmetry and Supergravity: in Gravitation, gauge the- ories and the early universe, 487-522, Ed. B.R. Iyer, Kluwer Academic Publishers (1989).

• **Electroweak Symmetry Breaking :**

Details will be announced soon.

• **Applied Supersymmetry :**

Syllabus : Dynamics of susy gauge theories. Models of susy theories, MSSM, mSugra. Susy breaking. (More details will follow).

• **The AdS/CFT Correspondence and Applications :**

Syllabus : Geometry of anti-de Sitter space. Quick review of essentials of large N gauge theories. The gravity/gauge theory dictionary (spectrum, correlators). Computations using the dictionary. The duality at finite temperature. Generalisations to vector like models. Applications to Quark-Gluon Plasma, QCD spectrum, Technicolour scenarios and Condensed matter systems (time permitting).

Prerequisites :

1) A second course in Quantum field theory would be desirable, especially a coverage of
(a) Gauge theories and their path integral quantisation (at the level of Peskin and Schroeder chap. 15 and 16)
(b) Renormalisation (at least at the level of chap. 10 of Peskin and Schroder). An acquaintance with the large N limit as in Gautam Mandal's 2012 SERC course or Coleman's article in Aspects of symmetry would be useful.

2) A working knowledge of general relativity including nontrivial black hole solutions of Einstein equations would be essential.

References : TASI lecture notes available on the archive, such as

- Maldacena (hep-th/0309246)
- Polchinski (arXiv: 1010.6134)
- d'Hoker and Freedman (hep-th/0201253)