

Justin R. David

Research Summary:

My research during 2006-2007 has been centered on two distinct aspects of string theory: i) Understanding the gauge/string duality in regimes where the string theory is strongly coupled while the gauge theory is free. ii) The study of the spectrum of dyonic states in certain class of string compactifications with $\mathcal{N} = 4$ supersymmetry.

On the topic of gauge/string duality, in collaboration with R. Gopakumar and the group at the Weizmann Institute we continued to investigate properties of the worldsheet conformal field theories which are conjectured to be dual to free large N gauge theories. These conformal field theories are constructed using the mapping of Feynman diagrams to the worldsheet suggested by R. Gopakumar. The modular invariance of these CFT's is shown to be built into the formalism. We show that correlation functions in these CFT's which are localized on subspaces of moduli space may be interpreted as delta-function distributions, and that this can be consistent with a local worldsheet description given some constraints on the operator product expansion coefficients.

In collaboration with D. Jatkar and A. Sen we obtained the spectrum of a class of quarter BPS dyons in a generic $\mathcal{N} = 4$ supersymmetric Z_N orbifold of type IIA string theory on $K3 \times T^2$ or T^6 . We also find the asymptotic expansion of the statistical entropy to the first non-leading order in inverse power of charges and show that it agrees with the entropy of a black hole carrying same set of charges after taking into account the effect of the four derivative Gauss-Bonnet term in the effective action of the theory. At present we are extending these methods to obtain the spectrum of BPS dyons in $\mathcal{N} = 2$ compactifications.

Publications:

1. Justin R. David, Ashoke Sen, *CHL Dyons and Statistical Entropy Function from D1-D5 System*, JHEP **0611 072**, (2006).
2. Justin R. David, Rajesh Gopakumar, *From spacetime to worldsheet: Four point correlators*, JHEP **0701 063**, (2007).
3. Justin R. David, Dileep P. Jatkar, Ashoke Sen, *Dyon Spectrum in $\mathcal{N} = 4$ Supersymmetric Type II String Theories*, JHEP **0611 073**, (2006).
4. Justin R. David, Dileep P. Jatkar, Ashoke Sen, *Dyon spectrum in generic $\mathcal{N} = 4$ supersymmetric Z_N orbifolds*, JHEP **0701 016**, (2007).

Preprints:

1. Ofer Aharony, Justin R. David, Rajesh Gopakumar, Zohar Komargodski , Shlomo S. Razamat, *Comments on worldsheet theories dual to free large N gauge theories* hep-th/0703141.

Conference/Workshops Attended:

1. *Indian strings meeting*, India, December, 2006.

Visits to other Institutes:

1. Tata Institute of Fundamental Research, Mumbai, India, April 2006.
2. Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, April-June 2006.
3. Utrecht University, Utrecht, The Netherlands, May 2006.
4. CERN, Geneva, Switzerland, June 2006.
5. Indian Institute of Technology, Kanpur, India, February 2007.
6. Weizmann Institute of Science, Rehovot, Israel, February 2007.

Invited Lectures/Seminars:

1. *Towards a string bit formulation of $\mathcal{N} = 4$ super Yang-Mills*, String theory and mathematical physics seminar, TIFR, Mumbai, April 2006.
2. *On the dyon partition function in $\mathcal{N} = 4$ string theories*, High energy theory seminar, ASICTP, Trieste, May 2006.
3. *On the dyon partition function in $\mathcal{N} = 4$ string theories*, String theory seminar, Utrecht University, Utrecht, May 2006.
4. *On the dyon partition function in $\mathcal{N} = 4$ string theories*, Theory seminar, CERN, Geneva, June 2006.
5. *From spacetime to worldsheet: Four point correlators*, Lecture at Indian strings meeting, Puri, December 2006.
6. *Black hole entropy in string theory*, Physics colloquium, IIT, Kanpur, February 2007.

7. *From spacetime to worldsheet: Four point correlators*, Physics seminar, IIT, Kanpur, February 2007.
8. *On the dyon partition function in $\mathcal{N} = 4$ string theories*, String theory seminar, Weizmann Institute of Science, Rehovot, February 2007.

Other Activities:

1. Teaching Mathematical Methods-I, August-December, 2006.
2. Supervised string project: Supersymmetry, January-March, 2007.
3. Member of national organizing committee: Indian strings meeting, December 2006.