

Ashoke Sen

Research Summary:

My research during the period April 2006 - March 2007 focussed on the study of black holes in string theory and gaining a precise understanding of the relationship between black hole entropy and statistical entropy obtained by taking the logarithm of the degeneracy of quantum states. In order to push this program to its logical end one needs to open two fronts: 1) developing tools for computing black hole entropy to greater accuracy and 2) computing degeneracy of quantum states in string theory to greater accuracy. Progress was made on both fronts in various collaborations. For the computation of black hole entropy we pushed the entropy function approach (which was developed during the previous year) to study entropy of various black holes in string theory in the presence of higher derivative terms. We also showed how the entropy function approach can be generalized to rotating black holes and how it can be used to derive general properties of entropy of non-supersymmetric black holes. For the computation of the statistical entropy we found exact expressions for the degeneracies of supersymmetric states in a class of $N=4$ supersymmetric string theories, and showed how the result agrees with the black hole entropy even after including the effect of higher derivative terms.

I also worked on the subject of open string tachyon condensation and showed that under certain circumstances the conventional open string tachyon can be given a geometric interpretation.

Publications:

1. J. R. David and A. Sen, "CHL dyons and statistical entropy function from D1-D5 system," JHEP **0611**, 072 (2006) [arXiv:hep-th/0605210].
2. D. Astefanesei, K. Goldstein, R. P. Jena, A. Sen and S. P. Trivedi, "Rotating attractors," JHEP **0610**, 058 (2006) [arXiv:hep-th/0606244].
3. J. R. David, D. P. Jatkar and A. Sen, "Dyon spectrum in $N = 4$ supersymmetric type II string theories," JHEP **0611**, 073 (2006) [arXiv:hep-th/0607155].
4. B. Sahoo and A. Sen, " α' -Corrections to Extremal Dyonic Black Holes in Heterotic String Theory," JHEP **0701**, 010 (2007) [arXiv:hep-th/0608182].
5. J. R. David, D. P. Jatkar and A. Sen, "Dyon spectrum in generic $N = 4$ supersymmetric $Z(N)$ orbifolds," JHEP **0701**, 016 (2007) [arXiv:hep-th/0609109].
6. A. Dabholkar, A. Sen and S. P. Trivedi, "Black hole microstates and attractor without supersymmetry," JHEP **0701**, 096 (2007) [arXiv:hep-th/0611143].

7. A. Dabholkar, N. Iizuka, A. Iqbal, A. Sen and M. Shigemori, "Spinning strings as small black rings," JHEP **0704**, 017 (2007) [arXiv:hep-th/0611166].
8. A. Sen, "Walls of Marginal Stability and Dyon Spectrum in N=4 Supersymmetric String Theories," **0705**, 039 (2007) [arXiv:hep-th/0702141].
9. A. Sen, "Geometric tachyon to universal open string tachyon," JHEP **0705**, 035 (2007) [arXiv:hep-th/0703157].

Conference/Workshops Attended:

1. *IPM String School & Workshop*, Iran, April 2006
2. *Strings 2006*, China, June 2006.
3. *IOP String School*, Bhubaneswar, India, September 2006.
4. *First Asian Winter school on String Theory*, Seoul, Korea, January 2007

Visits to other Institutes:

1. Stanford University, Stanford, USA, May 2006 (as SITP distinguished lecturer)
2. University of Chicago, Chicago, May 2006
3. Raman Research Institute, Bangalore, July 2006
4. Indian Institute of Science, Bangalore, August 2006
5. University of Rome, Rome, November 2006
6. Caltech, Pasadena, USA, February - March 2007 (as Moore distinguished scholar)

Invited Lectures/Seminars at Schools/Conferences:

1. *Entropy Function and Dyons Partition Function in CHL Models*, IPM String School lecture, IPM, Tehran, Iran, April 2006.
2. *New results from black hole entropy function*, Strings 2006 conference talk, Beijing, China, June 2006.
3. *Extremal Black Holes in String Theory*, IOP String School lectures, IOP, Bhubaneswar, India, September 2006.

4. *Extremal Black Holes in String Theory* First Asian Winter school on String Theory lectures, KIAS, Seoul, Korea, January 2007.

Academic recognition/Awards:

- Pius XI Gold Medal, Pontifical Academy of Sciences, 2006
- J C Bose Fellowship, DST, 2006

Other Activities:

1. Taught Statistical Mechanics, January - May 2006.
2. Taught Quantum Field Theory 2, August - December 2006.
3. Taught Flux Compactification, January - May, 2007.