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## Research Summary:

With J. R. David and A. Sen, I computed the spectrum of quarter BPS dyons in freely acting  $Z_2$  and  $Z_3$  orbifolds of type II string theory compactified on a six dimensional torus. For large charges the result for statistical entropy computed from the degeneracy formula agrees with the corresponding black hole entropy to first non-leading order after taking into account corrections due to the curvature squared terms in the effective action. The result is significant since in these theories the entropy of a small black hole, computed using the curvature squared corrections to the effective action, fails to reproduce the statistical entropy associated with elementary string states.

With J. R. David and A. Sen, I found the exact spectrum of a class of quarter BPS dyons in a generic  $N=4$  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 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.

With N. Banerjee and R. K. Jain, I studied interacting scalar field theory non-minimally coupled to gravity in the FRW background. We show that for a specific choice of interaction terms, the energy-momentum tensor of the scalar field vanishes, and as a result the scalar field does not gravitate. The naive space dependent solution to equations of motion gives rise to singular field profile. We carefully analyze the energy-momentum tensor for such a solution and show that the singularity of the solution gives a subtle contribution to the energy-momentum tensor. The space dependent solution therefore is not non-gravitating. Our conclusion is applicable to other space-time dependent non-gravitating solutions as well. We study hybrid inflation scenario in this model when purely time dependent non-gravitating field is coupled to another scalar field.

## Publications:

1. J. R. David, D. P. Jatkar and A. Sen, *Dyon Spectrum in  $N=4$  Supersymmetric Type II String Theories*, JHEP **0611**, 073, (2006)
2. J. R. David, D. P. Jatkar and A. Sen, *Dyon Spectrum in Generic  $N=4$  Supersymmetric  $Z_N$  Orbifolds*, JHEP **0701**, 016, (2007)

### **Preprints:**

1. N. Banerjee, R. K. Jain and D. P. Jatkar, *Non-Gravitating Scalar Field in the FRW Background*,

### **Conference/Workshops Attended:**

1. *Strings 2006*, China, June 2006.
2. *ISM06*, India, December 2006.
3. *From Strings to LHC*, India, January 2007.
4. *SERC THEP 2007*, India, January 2007.

### **Invited Lectures/Seminars:**

1. *Dyon Spectrum in Generic  $N=4$  Supersymmetric  $Z_N$  Orbifolds*, ISM06, IOP, Bhubaneswar, Puri, December 2006.
2. *Report on Brane-worlds working group*, From Strings to LHC, TIFR, Goa, January 2007.
3. *Introduction to Anomalies*, SERC THEP 2007, University of Hyderabad, Hyderabad, January 2007.