Main lines of research and results in the Oviedo group

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Main lines of research

1. Matrix models in pp-wave backgrounds
2. Giant gravitons in $AdS_m \times S^n$
3. The baryon vertex with magnetic flux
4. Confinement in $(Dp, \bar{D}p)$ systems
5. Attractor black holes and gravitational dielectric effect
6. Holographic Wilson loops in higher dimensional representations
7. AdS/CFT with flavors
8. Matrix Big Bangs
9. String gases and implied topics:
   - Equivalence of ensembles and extensivity
   - β-duality and the vanishing of the chemical potential

- Non-equivalence between Euclidean time compactification and Helmholtz free energy
- Phase transitions for string gases at the Hagedorn temperature

Results

1. Matrix models in pp-wave backgrounds (Y. Lozano and D. Rodríguez-Gómez)

Starting from the action for non-Abelian gravitational waves

- Extension of the BMN matrix model admitting a fuzzy 5-sphere as a supersymmetry preserving solution
- Type II pp-wave matrix models

(JHEP 0608 (2006) 022)

Project: Matrix models in $AdS_m \times S^n$ (Y. Lozano with N. Gutiérrez (phD student in Oviedo) and M. Ali-Akbari (phD student in Teheran, visitor in Oviedo))

2. Giant gravitons in $AdS_m \times S^n$ (Y. Lozano and D. Rodríguez-Gómez with B. Janssen (U. of Granada))

- Long term collaboration (started 2002)
- Thesis of D. Rodríguez-Gómez: "The dielectric effect in String Theory and its application to the microscopical description of giant gravitons", University of Oviedo, 2005.
- Microscopical description of giant gravitons in $AdS_m \times S^n$ backgrounds as dielectric gravitational waves expanding into various fuzzy manifolds
- Detailed description of the fuzzy S^1, S^3 and S^5 manifolds
- Kaluza-Klein giant graviton solution in $AdS_5 \times S^5$ (JHEP 0706 (2007) 028)

3. The baryon vertex with magnetic flux (Y. Lozano and D. Rodríguez-Gómez with B. Janssen (U. of Granada))

- Witten's baryon vertex with dissolved D1-branes.
- The number of D1's is bounded from above, which suggests a maximum R-charge.

(JHEP 0611 (2006) 082)

4. Confinement in $(Dp, \bar{D}p)$ systems (N. Gutiérrez and Y. Lozano)

- An explicit action describing the confined phase for the overall $U(1)$
- Dual description in terms of a generalized Higgs phase for the (relative) $(p-2)$-form field dual to the (overall) BI

- Tachyonic objects originate from open $D(p-2)$-branes stretched between the Dp and the $\bar{D}p$
- The F1 arises as the remnant world-volume soliton

(To appear soon)

5. Attractor black holes and gravitational dielectric effect (D. Rodríguez-Gómez)

- In the attractor geometry $AdS_2 \times S^2 \times \mathcal{M}$, the configurations of D2-branes with dissolved D0-branes relevant for the study of $N = 2$ 4 dim black holes can be understood in terms of D0-branes expanding by a purely gravitational dielectric effect

(JHEP 0601 (2006) 079)

6. Holographic Wilson loops in higher dimensional representations (D. Rodríguez-Gómez)

- The Wilson loops in tensor product representations computed in terms of D3 or D5-branes with F-strings dissolved are computed microscopically as sets of coincident loops expanding by dielectric effect.
- 't Hooft loops can be described in the same manner in terms of D1-branes

(Nucl. Phys. B752 (2006) 316)

7. AdS/CFT with flavors (D. Rodríguez-Gómez with D. Areán and A. Ramallo (U. Santiago))

- Theories with fundamental matter confined in a defect can be embedded in string theory in brane intersections. Different embeddings of the flavor branes correspond to different branches. It is shown that the Higgs branch corresponds to a brane recombination and (generically) involves the inclusion of a wv. vector field.

(Phys. Lett. B641 (2006) 393, JHEP 0705 (2007) 044)

8. Matrix Big Bangs (D. Rodríguez-Gómez with J. Bedford, C. Papageorgakis and J. Ward (Queen Mary))

- By gluing together two copies of the Craps, Sethi & Verlinde background a cosmology going from a Big Bang to a Big Crunch is constructed, as well as a Matrix String Theory describing the system

(Phys. Rev. D75 (2007) 085014)

9. String gases and implied topics (M.A.R. Osorio and Manuel Cobas and María Suárez)

- Thesis of Manuel Cobas: "A critical view on decompactification in a string gas", University of Oviedo, July 2006.

- Thesis of María Suárez: "Thermodynamics of D-particles in the IMF and some important remarks about the Hagedorn problem", University of Oviedo, July 2006.
- Study of the thermodynamical limit for a gas of strings

  (Int. J. Mod. Phys. A21 (2006) 3967, JHEP 0601 (2006) 059)
- Equivalence of ensembles and extensivity. Non-equivalence of ensembles for string gases rests upon non extensive terms that are very small corrections at high energy. They seem to be however thermodynamically negligible

  (JHEP 0601 (2006) 059, work in progress)