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Constituents, Fundamental Forces and Symmetries of the  
Universe

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## Research lines

- D-brane dynamics and phenomenological applications
- Integrability in the AdS/CFT correspondence
- Holography, black holes and the AdS/CFT correspondence
- Superstring theory from the supergravity point of view
- The gravitation of the vacuum

# D-brane dynamics and phenomenological applications

(L. E. Ibáñez, A. Font and Á. Uranga)

## Results

- Study of appearance of field theory operators from euclidean D-brane instantons in string compactifications
- Use of dimer diagram techniques to study systems of D-branes at singularities, and applications to (metastable) supersymmetry breaking

## References

*Coisotropic D8-branes and model-building*, A. Font, L. E. Ibáñez and F. Marchesano, *JHEP* **0609** 080, 2006, arXiv:hep-th/0607219 • *Neutrino Majorana masses from string theory instanton effects*, L. Ibáñez and Á. Uranga, *JHEP* **0703** 052, 2007. hep-th/0609213 • *Supersymmetry breaking metastable vacua in runaway quiver gauge theories*, I. García-Etxebarria, F. Saad and Á. Uranga, *JHEP* **0705** 047, 2007. arXiv:0704.0166 • *Instanton induced neutrino Majorana masses in CFT orientifolds with MSSM-like spectra*, L. E. Ibáñez, A.Ñ. Schellekens and Á. M. Uranga, *JHEP* **0706** 011, 2007. arXiv:0704.1079 • *Neutrino masses and mixings from string theory instantons*, S. Antusch, L. E. Ibáñez and T. Macri, arXiv:0706.2132 • *Dimers and orientifolds*, S. Franco, A. Hanany, D. Krefl, J.Park, Á. Uranga and D. Vegh, arXiv:0707.0298

## Integrability in the AdS/CFT correspondence

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(C. Gómez, R. Hernández and E. López)

### Results

- Proposal of a strong-coupling expansion for the scattering phase of  $AdS_5 \times S^5$  strings
- Identification of the Hopf algebra and the quantum-deformed magnon kinematics in planar  $\mathcal{N} = 4$  Yang-Mills

### References

*Quantum corrections to the string Bethe ansatz*, R. Hernández and E. López, JHEP **0607** (2006) 004, hep-th/0603204 • *The magnon kinematics of the AdS/CFT correspondence*, C. Gómez and R. Hernández, JHEP **0611** (2006) 021, hep-th/0608029 • *A crossing symmetric phase for  $AdS_5 \times S^5$  strings*, N. Beisert, R. Hernández and E. López, JHEP **0611** (2006) 070, hep-th/0609044 • *Integrability and non-perturbative effects in the AdS/CFT correspondence*, C. Gómez and R. Hernández, Phys. Lett. **B644** (2007), 375, hep-th/0611014 • *Quantum deformed magnon kinematics*, C. Gómez and R. Hernández, JHEP **0703** (2007) 108, hep-th/0701200

# Holography, black holes and the AdS/CFT correspondence

(J. L. F. Barbón, C. Gómez and K. Landsteiner)

## Results

- Analysis of the phase diagram of Little String Theory, using techniques from deconstruction. Found that LST density of states is only Hagedorn in a band of superheated states.
- Gluon saturation and black hole critical phenomena
- Computation of quasinormal modes for holographic meson melting in the strongly-coupled quark-gluon plasma. Absorption lengths in the plasma. Shear viscosity in a strongly-coupled non-commutative plasma.

## References

*Scaling phenomena in gravity from QCD*, L. Álvarez-Gaumé, C. Gómez and M. A. Vázquez-Mozo, Phys. Lett. B **649** (2007) 478, arXiv:hep-th/0611312 • *Holographic meson melting*, C. Hoyos, K. Landsteiner and S. Montero, JHEP **0704** 031, 2007 hep-th/0612169 • *Absorption lengths in the holographic plasma*, I. Amado, C. Hoyos, K. Landsteiner and S. Montero, arXiv:0706.2750 • K. Landsteiner and **J. Mas**, *The shear viscosity of the non-commutative plasma*, JHEP **0707** 088, 2007, arXiv:0706.0411 • *Deconstructing the little Hagedorn holography*. J. L. F. Barbón, C. A. Fuertes and E. Rabinovici, arXiv:0707.1158

# Superstring theory from the supergravity point of view

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(P. Meessen, T. Ortín, S. Vaulá)

## Results

- Classification of all the supersymmetric solutions of ungauged  $\mathcal{N} = 2$ ,  $d = 4$  supergravity and gauged  $\mathcal{N} = 2$ ,  $d = 5$  supergravity.
- Inclusion of brane-related dual fields in supergravity theories and study of the symmetry algebras that arise ( $E_{11}$ ).

## References

S. Vaulá, Phys. Lett. B **653** (2007) 95 arXiv:0706.1361 • P. Meessen, Fortsch. Phys. **55** (2007) 777 • J. Bellorín and T. Ortín, arXiv:0705.2567 • P. Meessen, Phys. Rev. D **76** (2007) 046006 arXiv:0705.1966 • S. Vaulá, Fortsch. Phys. **55** (2007) 827, hep-th/0701286 • S. Vaulá, JHEP **0703** 010, 2007, hep-th/0612130 • E. A. Bergshoeff, J. Hartong, T. Ortín and D. Roest, JHEP **0702** 003, 2007, hep-th/0612072 • T. Ortín, Fortsch. Phys. **55** 798, 2007, hep-th/0611117 • E. A. Bergshoeff, M. de Roo, S. F. Kerstan, T. Ortín and F. Riccioni, JHEP **0702** 007, 2007, hep-th/0611036 • J. Bellorín, P. Meessen and T. Ortín, JHEP **0701** 020, 2007 hep-th/0610196 M. Huebscher, P. Meessen and T. Ortín, Nucl. Phys. B **759** (2006) 228, hep-th/0606281 • J. Bellorín, P. Meessen and T. Ortín, Nucl. Phys. B **762** (2007) 229, hep-th/0606201 • T. Ortín, Annalen Phys. **15** 251, 2006 • J. Louis and S. Vaulá, JHEP **0608** 058, 2006, hep-th/0605063 P. Meessen and T. Ortín, Nucl. Phys. B **749** (2006) 291, hep-th/0603099 • E. A. Bergshoeff, M. de Roo, S. F. Kerstan, T. Ortín and F. Riccioni, JHEP **0607** 018, 2006, hep-th/0602280 • E. A. Bergshoeff, M. de Roo, S. F. Kerstan, T. Ortín and F. Riccioni, JHEP **0606** 006, 2006, hep-th/0601128 • T. Ortín, AIP Conf. Proc. **841** 162, 2006, gr-qc/0601003 • P. Meessen, Lett. Math. Phys. **75** 209, 2006 • J. Bellorín and T. Ortín, Nucl. Phys. B **726** 171, 2005, hep-th/0506056

# The gravitation of the vacuum

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(E. Álvarez)

- Results*
- Construction of unimodular theories where the vacuum gravitates.

- References*
- *Transverse Fierz-Pauli symmetry*, E. Álvarez, D. Blas, J. Garriga and E. Verdaguer, Nucl. Phys. B **756** (2006) 148, hep-th/0606019
  - *Renormalized masses of heavy Kaluza-Klein states*, E. Álvarez and A. F. Faedo, Phys. Rev. D **74** 124029, 2006 hep-th/0606267
  - *BRST analysis of unimodular theories*, E. Álvarez and J. J. Lopez-Villarejo, AIP Conf. Proc. **841** 3, 2006
  - *Quantum corrections to higher-dimensional theories*, E. Álvarez and A. F. Faedo, J. Phys. A **40** 6641, 2007 hep-ph/0610424
  - *Unimodular cosmology and the weight of energy*, E. Álvarez and A. F. Faedo, Phys. Rev. D **76** 064013, 2007 hep-th/0702184
  - *A comment on the matter-graviton coupling*, E. Álvarez and A. F. Faedo, arXiv:0707.4221



## Seminars

- C. A. Fuertes, *Deconstructing the Little Hagedorn holography*
- I. García-Etxebarria, *Non-supersymmetric meta-stable vacua from brane configurations*
- J. Gunnesson, *Star-triangle relation in AdS/CFT*