



Capacities/Research Potential  
FP7-REGPOT-2009-1

Project No. 228644

# CRETEHEPCOSMO

Crete Center for particle Physics and Cosmology

## Deliverable D6

Conference announcement on the website, presentations posted at website and report.

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Actual submission date:	18th month
Dissemination level:	PU

# **REPORT**

**CRETE CONFERENCE ON  
GAUGE THEORY  
AND  
THE STRUCTURE OF SPACETIME**

**ORTHODOX ACADEMY OF CRETE  
KOLYMVARI, CHANIA, CRETE**

**SEPTEMBER 11 – 18, 2010**

**THEME TITLE:** FP7-REGPOT-2008-1

**Project acronym:** Crete-HEP-Cosmo

**Project full title:** Crete Center for Particle Physics and Cosmology

**Grant Agreement No:** 228644

- **SCIENTIFIC PROGRAM/TALKS:** According to the format of the Conference we had one long review talk in the morning on a particularly interesting subject, followed by ten more specialized talks. Only one afternoon was devoted to an excursion to the South West corner of Crete. During lunch, dinner and coffee breaks one had the opportunity for extensive discussions and criticism with the speakers.
- **ELECTRONIC PROCEEDINGS:** The slides or transparencies of all talks have been posted in the [program webpage](#)

## Saturday 11 September

08:00 - 20:00	Arrivals
16:00 - 20:00	Registration
20:00-21:00	Welcome Drink
21:00	Dinner

## Sunday 12 September

08:00 - 08:45		Breakfast/Registration
08:45 - 09:00		Welcome and Opening
		<b>Morning Session Chairman: T. Tomaras</b>
09:00 - 10:30	<b>J. Heckman</b> IAS Princeton	F-theory model building
10:30 - 11:00		Coffee Break
11:00 - 11:30	<b>A. Zaffaroni</b> University of Milano-Bicocca	Massive type IIA and strong coupling
11:30 - 12:00	<b>V. Niarchos</b> University of Crete	Hairpin branes and tachyon-paperclips in holographic backgrounds
12:00 - 12:30	<b>J. Policastro</b> ENS Paris	Negative refraction from holography
12:30 - 13:00	<b>L. Mazzanti</b> Santiago de Compostela	Hydrodynamics from 5D dilaton-gravity
14:00		Lunch
		<b>Afternoon Session Chairman: T. Petkou</b>
17:00 - 17:30	<b>D. K. Hong</b> Pusan National University	Holographic QCD in three dimensions
17:30 - 18:00	<b>G. Kofinas</b> University of Crete	Gravitational bremsstrahlung in transplanclian scattering
18:00 - 18:30	<b>B. H. Lee</b> Sogang University	Holographic QCD-gluon condensation in dense media
18:30 - 19:00		Coffee Break
19:00 - 19:30	<b>Matt Lippert</b> University of Crete	A holographic model of the quantum hall effect
19:30 - 20:00	<b>M. Kulaxizi</b> University of Uppsala	Higher derivative gravity and entanglement entropy
20:00 - 20:30	<b>S. Murthy</b> LPTHE Paris	Stringy effects in black hole decay
21:00		Dinner

## Monday 13 September

09:00 - 10:30	<b>J. S. Hartnoll</b> Harvard University	<b>Morning Session Chairman: J. Ng</b> <b>Holography and Condensed Matter Physics</b>
10:30 - 11:00		<b>Coffee Break</b>
11:00 - 11:30	<b>R. Leigh</b> University of Illinois at Urbana-Champaign	<b>Fermions, holography and consistent truncations</b>
11:30 - 12:00	<b>K. Schalm</b> Leiden University	<b>Explaining Fermi liquid stability with AdS black holes</b>
12:00 - 12:30	<b>I. Antoniadis</b> CERN	<b>Non-linear supersymmetry and MMSM</b>
12:30 - 13:00	<b>K. Papadodimas</b> CERN	<b>Small hairy black holes in AdS<sub>5</sub> x S<sup>5</sup></b>
14:00		<b>Lunch</b>
17:00 - 17:30	<b>M. Bianchi</b> Rome "Tor Vergata"	<b>Afternoon Session Chairman: E. Kiritsis</b> <b>On stable higher-spin states in heterotic strings</b>
17:30 - 18:00	<b>S. Seki</b> Institute de Hautes Etudes Scientifiques	<b>Quark mass from tachyon</b>
18:00 - 18:30	<b>G. Bonelli</b> SISSA	<b>World-sheet and space-time aspects of topological open strings</b>
18:30 - 19:00		<b>Coffee Break</b>
19:00 - 19:30	<b>M. Jarvinen</b> University of Crete	<b>Decaying D-brane and Coulomb gas electrostatics</b>
19:30 - 20:00	<b>I. Iatrakis</b> University of Crete	<b>An AdS/QCD model from Sen's tachyon action</b>
20:00 - 20:30	<b>T. Ishii</b> RIKEN	<b>Baryons with massive strangeness in holographic QCD</b>
21:00		<b>Dinner</b>

## Tuesday 14 September

		<b>Morning Session Chairman: L. Alvarez- Gaume</b>
09:00 - 10:30	<b>D. Jafferis</b> Rutgers University	<b>Recent Advances in 3d Holography</b>
10:30 - 11:00		<b>Coffee Break</b>
11:00 - 11:30	<b>M. Taylor</b> University of Amsterdam	<b>Holography for Schroedinger spacetimes</b>
11:30 - 12:00	<b>A. Parnachev</b> University of Amsterdam	<b>High derivative gravities and AdS/CFT</b>
12:00 - 12:30	<b>S. Cremonesi</b> Tel Aviv University	<b>3d N=2 quiver gauge theories with flavours and M2 branes at toric CY<sub>4</sub> cones</b>
12:30 - 13:00	<b>A. Gustavsson</b> CQUEST	<b>Associative star three-product</b>
13:30		<b>Lunch</b>
17:00 - 17:30	<b>U. Lindstrom</b> Uppsala University	<b>Afternoon Session Chairman: R. Leigh</b> <b>Extended supersymmetry and geometry</b>
17:30 - 18:00	<b>F. Benini</b> Princeton University	<b>Gauge-gravity duality for d-wave superconductors: prospects and challenges</b>

18:00 - 18:30	<b>K. Narain</b> ICTP Trieste	<b>Flows in 2-dimensions SCFT and YM instantons</b>
18:30 - 19:00		<b>Coffee Break</b>
19:00 - 19:30	<b>N. Prezas</b> Bern University	<b>Non-geometric string backgrounds and chiral boson models</b>
19:30 - 20:00	<b>U. Gursoy</b> ITF Utrecht	<b>A new approach to holographic superconductors</b>
20:00 - 20:30	<b>H. Zhang</b> University of Crete	<b>Construct S-matrix from BCFW</b>
21:00		<b>Dinner</b>

## Wednesday 15 September

		<b>Morning Session Chairman: V. Kazakov</b>
09:00 - 10:30	<b>R. Myers</b> Perimeter Institute	<b>Holographic c-theorems</b>
10:30 - 11:00		<b>Coffee Break</b>
11:00 - 11:30	<b>A. Tseytlin</b> Imperial College	<b>On semiclassical approximation for correlators of closed string vertex operators in AdS<sub>5</sub> × S<sup>5</sup></b>
11:30 - 12:00	<b>M. B. Green</b> University of Cambridge	<b>String dualities and ultraviolet behaviour of supergravities</b>
12:00 - 12:30	<b>J. de Boer</b> University of Amsterdam	<b>Black holes and exotic states</b>
12:30 - 13:00	<b>A. Tanzini</b> SISSA	<b>AGT conjecture: from M theory to fractional quantum Hall states</b>
13:00 - 19:00		<b>Excursion</b>
21:00		<b>Dinner</b>

## Thursday 16 September

		<b>Morning Session Chairman: M. Taylor</b>
09:00 - 10:30	<b>G. Korchemsky</b> CEA Saclay	<b>Scattering amplitudes, correlation functions and Wilson loops in SYM theory</b>
10:30 - 11:00		<b>Coffee Break</b>
11:00 - 11:30	<b>K. Sfetsos</b> University of Patras	<b>Coset CFTs, non-abelian T-duality and high spin sectors</b>
11:30 - 12:00	<b>I. Bena</b> CEA-Saclay	<b>Anti-branes in Klebanov-Strassler</b>
12:00 - 12:30	<b>K. Stelle</b> Imperial College	<b>Non-renormalization theorems in extended supergravities</b>
12:30 - 13:00	<b>R. Janik</b> Jaggielonian University	<b>Correlation functions of operators dual to classical strings</b>
13:30		<b>Lunch</b>
		<b>Afternoon Session Chairman: D. Lust</b>
17:00 - 17:30	<b>E. Bergshoeff</b> University of Groningen	<b>Massive gravity in three dimensions</b>
17:30 - 18:00	<b>R. Meyer</b> University of Crete	<b>Effective holographic theories for condensed matter systems</b>
18:00 - 18:30	<b>B. S. Kim</b> University of Crete	<b>AdS in light-cone and Schroedinger space</b>
18:30 - 19:00		<b>Coffee Break</b>

19:00 - 19:30	<b>Y. Lozano</b> University of Oviedo	<b>Charged particle-like branes in ABJM</b>
19:30 - 20:00	<b>P. Koerber</b> KU Leuven	<b>Classical dS compactifications of type IIA supergravity</b>
20:00 - 20:30	<b>N. Banerjee</b> ITF Utrecht	<b>Holographic hydrodynamics</b>
21:00		<b>Dinner</b>

## Friday 17 September

		<b>Morning Session Chairman: K. Stelle</b>
09:00 - 10:30	<b>V. Kazakov</b> ENS Paris	<b>Recent advances in integrability in N=4 SYM Theory</b>
10:30 - 11:00		<b>Coffee Break</b>
11:00 - 11:30	<b>C. Bachas</b> ENS Paris	<b>Gravity localization in string theory</b>
11:30 - 12:00	<b>C. Pope</b> Texas A&M	<b>Kaluza-Klein Consistency, Pauli Reductions and the Breathing Mode</b>
12:00 - 12:30	<b>D. Lust</b> Munich Max Planck	<b>New developments in flux compactifications and generalized geometries</b>
12:30 - 13:00	<b>A. Paredes</b> University of Barcelona	<b>D3-D7 quark gluon plasmas</b>
13:30		<b>Lunch</b>
		<b>Afternoon Session Chairman: M. Bianchi</b>
17:00 - 17:30	<b>M. Costa</b> University of Porto	<b>On three-point correlation functions in gauge/gravity duality</b>
17:30 - 18:00	<b>N. Obers</b> Niels-Bohr Institute	<b>Thermal brane/anti-brane blackfold</b>
18:00 - 18:30	<b>A. Donos</b> Imperial College London	<b>Lifshitz solutions in string/M-theory</b>
18:30 - 19:00		<b>Coffee Break</b>
21:00		<b>Dinner</b>

## Saturday 18 September

08:00 - 08:45		<b>Breakfast - Departure</b>
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## • IMPACT ON THE CENTER

The impact of the «Crete Conference on Gauge Theories and The Structure of Spacetime» on the CCTP was multifold. Members of the Center came in close and extensive contact with top researchers and hot topics on the subject of the Conference. This will allow them to further their research, provide important visibility to the Center, its staff and other members, and in the long-run advance the status of the Center on the European research map.

On the scientific side, the topics presented in the Conference and thoroughly discussed include:

- (i) Applications of Holographic methods to the study of strongly coupled systems. Such methods, based on what is called AdS/CFT correspondence have been applied to the study of formal properties of String Theory and N=4 Super Yang-Mills gauge theory, as well as of the behavior of Quantum Chromodynamics, especially in relation to the Quark-Gluon plasma, a popular application which comes under the name AdS/QCD or Gauge/Gravity correspondence. During the last few years this approach has attracted a lot of attention and is being applied to Condensed Matter Theory (CMT) in an effort to shed light and understand interesting phenomena taking place in “down to earth” material systems. So, this topic is very broad and lies at the heart of scientific interests of several members of the CCTP. All aspects and applications of the general approach were extensively presented and discussed by many speakers of the Conference. Specifically, several talks were devoted to applications of these methods to Quantum Chromodynamics, hydrodynamics, superconductivity, and the Quantum Hall effect. In addition, the recent developments towards the proof of integrability of the N=4 super Yang-Mills Gauge Theory were also discussed.
- (ii) String theory model building, F-theory model building and properties of supergravity theories, also among the interests of a few members of the Center, were the subjects of several talks in the conference. Of particular interest was the study of the ultraviolet behavior of supergravity theories, as well as the construction of viable low energy particle physics models based on string theory.
- (iii) A few talks in the conference dealt with Black Hole Physics. With string effects in the decay of a BH, with “hairy” BHs in anti-de Sitter space, in BHs and other exotic states, with the issue of bremsstrahlung gravitational radiation in ultrarelativistic particle collisions and its consequence on BH production in colliders. The physics of Black Holes has been among the interests of members of the Center. So, the conference was a nice opportunity for them to exchange ideas on related problems with other world experts.
- (iv) Finally, other topics such as the non-linear realization of supersymmetry and its phenomenological consequences, or the study of massive gravity in 3-dimensions, stable higher-spin states, among others, offered new insights into issues related to gauge theories and the structure of spacetime, the main theme of the Conference.

The members of the Center actively participated in discussions, both during the talks and in private, with the visiting scientists focusing primarily on the topics of their own research. The junior members of the Center had similar extensive contacts.

- **ADVERTISEMENT:** The Conference was announced and advertised in many ways:

(i) On the website of the Center: <http://hep.physics.uoc.gr/conf09>

(ii) On the University, Crete Research Center [http://www.uoc.gr/announcement\\_1.php?id=700](http://www.uoc.gr/announcement_1.php?id=700) , and other conference announcement sites.

(iii) Via emails to worldwide scientists and research groups relevant to the subject.

(iv) Through a press release to the local and national press.

- **CONFERENCE EXPENSES**

<b>Expenses</b>	<b>Amount</b>
Travel and Accomodation expenses	31.330,86
Conference room	690,00
Excursion and Banquet	1.766,30
<b>TOTAL</b>	<b>33.787,16</b>

The Following scientists were supported with Travel and Accommodation expenses:

1. Alvarez Gaume Luis ( CERN )
2. Antoniadis Ignatios ( CERN )
3. Bachas Costas ( LPT, Ecole Normale, Paris )
4. Bena Iosif ( IPhT, CEA-Saclay )
5. Bergshoeff Eric ( University of Groningen )
6. Constantinou Yiannis ( University of Crete )
7. De Boer Jan ( Institute for Theoretical Physics, University of Amsterdam )
8. Ditsas Petros ( University of Crete )
9. Donos Aristomenis ( Imperial College London )
10. Floratos ( University of Athens )
11. Green Michael ( DAMTP, Cambridge )
12. Gursoy Umut ( Utrecht )
13. Hartnoll Sean ( Harvard University )
14. Heckman Jonathan ( Institute for Advanced Study )
15. Hong Deog-Ki ( Department of Physics Pusan National University )
16. Iatrakis Ioannis ( University of Crete )
17. Jafferis Daniel ( IAS )
18. Janik Romuald ( Jagiellonian University )



19. Jarvinen Matti ( University of Crete )
20. Kazakov Vladimir ( Ecole Normale Superieure )
21. Kim Bom Soo ( IESL-FORTH, University of Crete )
22. Kiritsis Elias ( University of Crete )
23. Kofinas Georgios ( University of Crete )
24. Korchemsky Gregory ( IPhT, Saclay )
25. Lee Bum-Hoon ( Sogang University )
26. Leigh Rob ( University of Illinois )
27. Lindstrom Ulf ( Uppsala University )
28. Lippert Matthew ( University of Crete )
29. Luest Dieter ( Max-Planck-Institut fuer Physik )
30. Makaki Eva ( University of Crete )
31. Mazzanti Liuba ( University of Santiago de Compostela )
32. Meyer Rene ( University of Crete )
33. Myers Robert ( Perimeter Institute )
34. Narain Kumar ( ICTP, Trieste )
35. Niarchos Vasilis ( University of Crete )
36. Obers Niels ( Niels Bohr Institute )
37. Paredes Galan Angel ( University of Barcelona )
38. Parnachev Andrei ( Stony Brook )
39. Petkou Tassos ( University of Crete )
40. Policastro Giuseppe ( LPTENS )
41. Pope Christopher ( Texas A&M University )
42. Schalm Koenraad ( Leiden University )
43. Seki Shigenori ( Institut des Hautes Études Scientifiques )
44. Sfetsos Konstadinos ( University of Patras )
45. Spirin Pavel ( Moscow State University )
46. Stelle Kelly ( Imperial College London )
47. Taylor Marika ( University of Amsterdam )
48. Tomaras Theodore ( University of Crete )
49. Tsamis Nick ( University of Crete )
50. Tseytlin Arkady ( Imperial College London )
51. Yamada Daisuke ( University of Crete )
52. Zhang Hongbao ( University of Crete )

- CONCLUSIONS:** The scientific conclusions of the Conference may be briefly summarized as follows: (a) The AdS/CFT conjecture has been extended, appropriately modified and used recently to the study of open problems in a wide variety of fields ranging from non-relativistic hydrodynamics, to d-wave superconductors, to the quark-gluon plasma phase of Quantum Chromodynamics (QCD), N=4 super Yang-Mills gauge theory, to Cosmology. Interesting conclusions and several in principle testable predictions about the behavior of such as well as other exotic systems (e.g. negative index of refraction materials) have been drawn. It is becoming more and more clear that these holographic techniques will continue to play an important role in physics. So, experts (among which several members of our group) are encouraged to extend these ideas and intensify their efforts to further improve the applicability of this approach. (b) Black Holes continue to attract considerable interest. New types of hairy BHs were presented in the Conference. String effects relevant to the BH decay were studied and a nice classical computation of the gravitational bremsstrahlung radiation in transplanckian particle collisions was presented, in connection with its potential relevance to the estimation of the BH production cross-section in colliders such as the LHC. (c) On the more formal front, the most recent progress in the on-going effort to prove the integrability of N=4 super Yang-Mills in the planar limit and the renormalizability of N=8 supergravity were also presented. The combination of analytical and numerical results presented seem quite convincing about the integrability of the planar N=4 theory. The UV behavior of supergravity is less clear. (d) It was also interesting to hear about the phenomenological consequences of the non-linearly realized supersymmetry, the properties of massive 2+1-dimensional gravity and about the most recent progress in string- and F-theory model building, in an effort to connect these theories with the real World.
- ORGANIZATION/PARTICIPANTS:** The scientific committee and the local organizing committee may be found on the conference website <http://hep.physics.uoc.gr/conf09>. The total number of invited participants was eighty-seven. Of those 14 were local researchers, members of our Crete Center for Theoretical Physics (CCTP), and the CCTP secretary. The remaining 73 came from essentially all countries of Europe, America and the Far East.

### **List of Foreign Participants**

1. Alvarez-Gaume Luis ( CERN )
2. Antipin Oleg ( Helsinki Institute of Physics )
3. Antoniadis Ignatios ( CERN )
4. Bachas Costas ( LPT, Ecole Normale, Paris )
5. Banerjee Nabamita ( ITF, Utrecht )

6. Bena Iosif ( IPhT, CEA-Saclay )
7. Benini Francesco ( Princeton University )
8. Benishti Nessi ( University of Oxford )
9. Bergshoeff Eric ( University of Groningen )
10. Bianchi Massimo ( University of Roma )
11. Bonelli Giulio ( SISSA )
12. Chowdhury Borun ( University of Amsterdam )
13. Costa Miguel ( Universida de do Porto )
14. Cremonesi Stefano ( Tel Aviv University )
15. De Boer Jan ( Institute for Theoretical Physics, University of Amsterdam )
16. Donos Aristomenis ( Imperial College London )
17. Dutta Suvankar ( Swansea University )
18. Floratos Emmanuel ( University of Athens )
19. Gerigk Sebastian ( ETH, Zurich )
20. Green Michael ( DAMTP, Cambridge )
21. Gursoy Umut ( Utrecht )
22. Gustavsson Andreas ( CQuest )
23. Hartnoll Sean ( Harvard University )
24. Hartong Jelle ( University of Bern )
25. Heckman Jonathan ( Institute for Advanced Study )
26. Hong Deog-Ki ( Pusan National University )
27. Ishii Takaaki ( RIKEN )
28. Jafferis Daniel ( IAS )
29. Janik Romuald ( Jagiellonian University )
30. Janssen Bert ( University of Granada )
31. Kazakov Vladimir ( Ecole Normale Superieure )
32. Kim Bom Soo ( IESL-FORTH, University of Crete )
33. Koerber Paul ( K.U. Leuven )
34. Korchemsky Gregory ( IPhT, Saclay )
35. Kulaxizi Manuela ( University of Amsterdam )
36. Lee Bum-Hoon ( Sogang University )
37. Leigh Rob ( University of Illinois )
38. Lindstrom Ulf ( Uppsala University )
39. Lozano Yolanda ( University of Oviedo )
40. Luest Dieter ( Max-Planck-Institut fuer Physik )
41. Masaki Shigemori ( University of Amsterdam )
42. Mazzanti Liuba ( University of Santiago de Compostela )
43. Molgado Alberto ( Universidad de Zacatecas )
44. Moura Filipe ( University of Minho )
45. Moutsopoulos George ( Peking University )
46. Murthy Sameer ( LPTHE, Paris )
47. Myers Robert ( Perimeter Institute )
48. Narain Kumar ( ICTP, Trieste )
49. Ng Y. Jack ( University of North Carolina )
50. Obers Niels ( Niels Bohr Institute )
51. Papadodimas Kyriakos ( University of Amsterdam )
52. Paredes Galan Angel ( University of Barcelona )
53. Parnachev Andrei ( Stony Brook )
54. Pawelczyk Jacek ( University of Warsaw )

55. Poghossian Rubik ( University of Rome "Tor Vergata" )
56. Policastro Giuseppe ( LPTENS )
57. Pope Christopher ( Texas A&M University )
58. Prezas Nikolaos ( University of Bern )
59. Ritter Patricia ( University of Edinburgh )
60. Samsonyan Marine ( University of Rome "Tor Vergata" )
61. Schalm Koenraad ( Leiden University )
62. Seki Shigenori ( Institut des Hautes Études Scientifiques )
63. Sfetsos Konstadinos ( University of Patras )
64. Spirin Pavel ( Moscow State University )
65. Stelle Kelly ( Imperial College London )
66. Takeuchi Shingo ( APCTP )
67. TANZINI Alessandro ( SISSA )
68. Taylor Marika ( University of Amsterdam )
69. Tseytlin Arkady ( Imperial College London )
70. Uruchurtu Linda I ( Imperial College )
71. Vagenas Elias ( Academy of Athens )
72. Zaffaroni Alberto ( University Milano-Bicocca )
73. Zoakos Dimitrios ( University of Porto )

### **List of Local Participants**

1. Petros Ditsas (University of Crete)
2. Ioannis Iatrakis (University of Crete)
3. Matti Jarvinen (University of Crete)
4. Elias Kiritsis (University of Crete)
5. George Kofinas (University of Crete)
6. Ioannis Konstantinou (University of Crete)
7. Matthew Lippert (University of Crete)
8. Rene Meyer (University of Crete)
9. Vassilis Niarchos (University of Crete)
10. Tassos Petkou (University of Crete)
11. Theodore Tomaras (University of Crete)
12. Nicholas Tsamis (University of Crete)
13. Daiske Yamada (University of Crete)
14. Hong Bao Zhang (University of Crete)
15. Eva Makaki (secretary, University of Crete)