Capacities/Research Potential
FP7-REGPOT-2009-1

Project No. 228644

CRETEHEPCOSMO

Crete Center for particle Physics and Cosmology

Deliverable D5

Outgoing+Incoming visits per researcher and per visit

Project start date:	01/04/20009
Project duration:	41 months
Due date of deliverable:	After 1rst year
Actual submission date:	13th month
Dissemination level:	PU

Outgoing + Incoming visits

There has been 16.75 man-months of out going visits and 13.3 months of incoming visits at a total cost of 114,116 euros, which amounts to an average cost of 3800 euros per man/month. This is more efficient that the planned 5700 euros per man/month.
There have been some small changes compared to the main lines of the annex I in order to make the implementation more efficient.

1) There have been more visits of the coordinator to two of the partner-institutions, namely APC in Paris and CERN in Geneva. The main reasons for this are the these two institutions are involved in three of the most important experimental efforts currently in the field. Namely at CERN LHC Is running and this is is the most important current experiment in high energy physics, with already interesting results in the realm of the strong interactions. APC is the main partner institutions at the Planck mission, the most important current mission to study the CMB background radiation that has turned out to be a gold-mine for data in cosmology. They are also the main European institution behind the LISA mission that is a planned major gravitational wave detector in space.

2) There have been coordinated meetings with partner institution members in third locations, typically high level meetings. There was an added value for this, and this is the fact that the networking aspect of this action was combined with a higher visibility and impact action (that of presenting work in a meeting) .

Concluding, the implementation of this action so far has been very successful and its impact for the Crete Center is sizeable.

We present below a detailed report of all outgoing and incoming visits.

outgoing visits

Elias Kiritsis (13/5/09-17/5/09) Brussels. Participation in the workshop "Cosmological Frontiers in Fundamental Physics"
(http://www.solvayinstitutes.be/Activities/CosmoFrontiers/CFFP.html)
This was co-organized by one of the partner institutions, APC, Paris.
The work presented was on the cosmology of Horava-Lifshitz gravity, done together with G. Kofinas from CCTP. This was a world class meeting with many of the top players in the field participated. There was intense discussion on the Horava-Lifshitz gravity theories that were recently introduced, as well as on other relevant issues in fundamental cosmology. Some first discussions were started towards developing closer research and education relations with the Brussels science community.

Elias Kiritsis (25/5/2009-30/5/2009) Paris. Visit to APC. Collaboration with Fransesco Nitti, and Liuba Mazzanti on holographic QCD and transport calculations. Discussions with the director of the lab, P. Binetruy on the possibilities of research collaboration between CCTP and APC.

Elias Kiritsis (4/6/2009-11/6/2009) Paris. Visit to ENS. Seminar on recent work on Horava-Lifshitz gravity and its implications for cosmology at APC. Collaboration with Fransesco Nitti, and Liuba Mazzanti on holographic QCD and transport calculations. Collaboration with C. Charmousis on the thermodynamics on novel charged black hole solutions found recently and their applications in physical systems.

Elias Kiritsis (15/6/2009-18/6/2009) Warsaw. Participation and lecture at the annual meeting on String Phenomenology (http://www.fuw.edu.pl/~sp09/). This was an major meeting where most parter institutions were present and participating in the International Commitete. More concrete there was Crete (Kiritsis), CERN (Antoniadis, Uranga, Wells), Roma (Bianchi), Munich (Lust, Blumenhagen), Cambridge (Quevedo) . This is a conference where the most important works of the year in the relevant field are presented. Kiritsis lectured on the relation between the structure of local orientifold configurations of the Standard Model stack and the possibility of mass hierarchies in such vacua, generated by instanton effects as well as possible scalar vevs. He has also discussed with many of the top people of the string phenomenology community (Antoniadis, Bianchi, Lust Blumenhagen, Langacker, Schellekens, Quevedo, Uranga, Wells, Pokorski) on issues related to signals at the forthcoming LHC experiments.

Elias Kiritsis (21/6/2009-26/6/2009) Roma. Participation and lecture at the annual String theory conference (Strings 2009) (http://strings2009.roma2.infn.it/home.html). This is THE main annual conference in the field of string theory. Kiritsis gave a review plenary talk where the work of the CCTP group was presented along with other contributions in the same direction, namely the construction of holographic models for QCD. This conference had over 500 participants, and linked to numerous discussions with senior colleagues on many physics issues. In particular there were exchanges with S. Gubser on holographic QCD, and M. Bianchi on Holographic renormalization.

Elias Kiritsis (26/7/2009-2/8/2009) Pusan Korea. Coordinated participation as two main lecturers in the APCTP school and workshop with Nick Dorey from Cambridge.
Kiritsis lectured presenting CCTP work at the APCTP focus program on Aspects of Holography and Gauge/string duality held at APCTP, Postech University (http://beauty.phys.pusan.ac.kr/apctp2009/) .
The lectures presented result on the zero temperature structure of holographic models of QCD, as well the associated spectra, flavor and the meson sector, the finite temperature structure and the deconfining first order phase transitions.
N. Dorey lectured on integrability in string theory a complementary topic that aims at solving string theories reelevant for gauge theories.
There were also discussions and interaction with the main scientists of the field in Korea (S J. Sin, B. H. Lee, P. J. Yi, D K. Hong). Preliminary discussion on research and collaboration between CCTP and APCTP, KIAS and CQuEST were launched.

Elias Kiritsis (7/8/2009-14/8/2009) CERN. One week visit to give a Heavy Ion forum colloquium, to the heavy ion physics community comprising mostly experimentalist in the ALICE experiment at CERN. The recent results from the CCTP were presented on the calculation of the bulk viscosity and drag force from a holographic model of QCD.

A seminar was also given at the CERN Theory group on SU(5) orientifolds in string theory and the structure of their effective theories. In particular, instanton generation of quark masses and their correlations to proton decay was presented.

Elias Kiritsis (14/8/2009-8/9/2009) Paris. Participation at the XXXIXeme INSTITUT D'ETE, held at ENS(http://www.lpt.ens.fr/spip.php?article131&lang=fr). Presented the CCTP results on the holographic QCD calculation of transport phenomena, and in particular the bulk viscosity and the drag force for heavy quarks. Visited also APC and collaborated with Fransesco Nitti, Umut Gursoy, Liuba Mazzanti (on the holographic calculation of stress tensor correlators in QCD) Vasilis Niarchos (On two dimensional toy models of the large N correspondence) and Michael Lennek (on anomalous U(1)s in orientifold models). Interacted and exchanged views with de Boer and Skenderis (Amsterdam), Hull (Imperial), Sagnotti (Pisa), Yannick (Cracow), Ferrari and Craps (Brussels).

Theodoros Tomaras (30/8/2009-17/9/2009) CERN. Discussion with Professor Veneziano for issues related to the phenomenon of gravitational bremsstrahlung during particle collisions in Minkowski space-times of arbitrary dimensions and also in compacted space times relevant to the TeV-scale gravity with Large Extra Dimensions scenario. The problem of bremsstahlung is crucial in order to decide if in the context of the above scenario, one should expect black holes to be produced in the forthcoming experiments with the LHC at CERN. Additionally, there was a little chat with Dr. Giudice, who is also involved in black hole physics at CERN. Attended the "Cosmo 2009" conference,(http://indico.cern.ch/conferenceDisplay.py?confId=46758) which took place at CERN during my visit and participatde in the Tomalla prize ceremony in the nearby University of Geneva to honor Professors A. Starobinskii and V. Mukhanov" for their work in Gravity". Collaboration with another visitor of CERN, Dr. A. Koshelev on our common project on an alternative brane-cosmology model.

Elias Kiritsis (8/9/2009-11/9/2009), Porto. Coordinated Participation of Kiritsis (Crete), Kazakov and Zarembo (ENS), Oz (Israel), Wiedeman (CERN), at the ESF Exploratory Workshop on Applications of AdS/CFT to QCD, (http://faraday.fc.up.pt/cfp/ESFworkshop/). This workshop brought together scientists from traditional approaches to QCD as well as those working on the Ad/CFT correspondence in order to study strong coupling physics in the quark gluon plasma. The work of the CCTP group was presented on finite temperature holographic desription of QCD as well as the calculation of transport coefficients notable the bulk viscosity and the drag force. One very important outcome was the building up of a new network of collaboration in the area of heavy ion physics and strongly coupled QCD. The CCTP is one of the prominent members of it. This will be proposed to ESF of funding.

Elias Kiritsis (12/9/2009-14/9/2009) Corfu. Coordinated participation at the School and Workshops on Cosmology - Strings: Theory - Cosmology – Phenomenology (http://www.physics.ntua.gr/corfu2009/st.html). This was coorganized by the groups at ENS, Munich, CERN among others. This is a major advanced school in the field with more than 100 students pre- or post PhD. The lectures delivered reviewed work done at CCTP on the subject of holographic QCD and its applications in the understanding of the quark gluon plasma, in contact with experiments at RHIC and soon at LHC.

Elias Kiritsis (20/9/2009-26/9/2009) Milos. Participation and lectures in the 5th Aegean summer school: "From gravity to thermal gaue theories: The AdS/CFT correspondence" (http://www.physics.ntua.gr/cosmo09/Milos2009/). Cooordinated participation with C. Skenderis from Amsterdam as well as other physicists from Europen institutions. The School was organized by associate members of the Center, from the Athens Polytechnic. Review lectures on recent work done at CCTP on the subject of holographic QCD and its applications in the understanding of the quark gluon plasma, in contact with experiments at RHIC and soon at LHC. Discussions with many top experts on applications of AdS/CFT T condensed matter problems.

Rene Meyer (20/9/2009-26/9/2009) Milos. The purpose of his trip to Adamas, Milos Island was to take part in the summer school “Fifth Aegean Summer School—From Gravity to Thermal Gauge Theories: The AdS/CFT Correspondence”, which was held Sep 21-26, 2009 in the Milos Conference Centre “George Iliopoulos”. In particular, he gave a talk on his own research work, titled “Flavored Holographic Duals of 3D Chern-Simons-Matter Theories”

Elias Kiritsis (27/9/2009-7/10/2009) Brussels He Has given several introductory lectures on string theory in the PhD lecture program of ENS/Brussels/Amsterdam. He has also given a seminar on his recent work on holographic QCD and bulk viscosity. Collaborated with A. Koshelev from VUB on issues related to cosmological perturbations in holographic cosmology. Has discussed further the development of research and education relations with the Brussels science community via the Solvay Institute.

Dr Yamada has visited the theory group at Hebrew University and Tel Aviv University from 18/10/09-27/10/09. He has given a talk in both places on his latest work on black hole spacetimes with Schrondinger scaling symmetry. He has interacted with the members of the local groups, S. Elitzur, A. Giveon, Barak Kol, Yaron Oz, Jacob Sonnenschein, and Nissan Itzhaki. He discussed in particular the non-relativistic limit in hydrodymamics in relation to gravity and the AdS/CFT correspondence with Y. Oz, and the issue of finite chemical potential physics in the meson sector with J. Sonnenschein. These discussions are at the heart of his research work in Crete.

Ioannis Iatrakis, Florence (Nov 22 – Dec 11 2009), Florence. http://laces.web.cern.ch/Laces/LACES09/lectures09.html He stayed at Florence from November 22nd to December 11th , 2009 to attend the LACES 2009 school on String Theory and Quantum Field Theory after the suggestion of G. Dvali (CERN) a top researcher in our field who was lecturing at the meeting. In particular, the lectures were about Geometrical Methods for String Compactifications, Supergravity, D-Brane Engineering and AdS/CFT and Physics beyond the Standard Model. He also gave a short presentation (10 minutes long) to the participants and organizers of the meeting about the research he is currently doing. Specifically, he talked about an AdS/QCD model that is described by Sen’s tachyon action.

Elias KIritsis (25-28/11/2009) ENS. Participated at the meeting AdS/CFT: strongly coupled systems and exact results that took place 26-27 November 2009 at Ecole Normale Superieure, Paris (http://www.lpt.ens.fr/Conferences/Paris2009/index.html).

It focused on recent advances on the applications of the AdS/CFT correspondence to strongly coupled systems, notably the quark-gluon plasma in QCD as well as condensed matter physics applications. His work was presented by his collaborator F. Nitti from APC.
He discussed physics with J. Zaanen (Leiden), S. Hartnoll (Harvard), E. Iancu (Saclay), U. Gursoy (Utrecht) Yaron Oz (Tel Aviv), T Takayanagi (IPMU), C. Zarembo (ENS), M. Rangamani (Durham), J Cassalderey Solana (CERN), V. Niarchos (E. Polytechnique), Costas Bachas (ENS).

Hong Bao Zhang (ENS, Paris 25-29 November). He stayed at ENS for a conference on AdS/CFT correspondence, QCD scattering amplitudes and related issues. (http://www.lpt.ens.fr/Conferences/Paris2009/index.html). He benefitted much from this conference by getting to know the state of the art in this research field. In particular there were presentations on applications to QCD at storing coupling, strongly correlated systems in condensed matter and hydrodynamics. He has discussed with Yaron Oz on the role of Penrose inequalities in the context of AdS/CFT and hydrodynamics, with Valentin Khoze on scattering amplitude in twister space, and with Mukund Rangamani on how to map the horizon quantities to the boundary.

Rene Meyer (Paris, Munich Nov 25-Dec 5, 2009)
1. In Paris, he took part in the workshop "AdS/CFT: strongly coupled systems and exact results", which was held at the Institute Henri Poincare on Nov 26 and at the Ecole Normale Superieure on Nov 27. The purpose of this trip was to keep himself updated on applying holographic methods to QCD and condensed matter systems, a field he is also working on. IHeattended all the talks listed on
http://www.lpt.ens.fr/Conferences/Paris2009/Programme.htm .
He also discussed with T. Takayanagi on his recent work on holographic superconductor/ insulator transitions at zero temperature (hep-th/0911.0962), with A. Cap on the results presented in his talk, as well as with M. Rangamani on the relationship between the Choptuik scaling regime in gravity and the hydrodynamic regime in the dual field theory.
2. In Munich, he took part in the workshop "Workshop on Interfaces and Wall-crossings", which was held at the Arnold Sommerfeld Center for Theoretical Physics of the Ludwig-Maximilians-University Munich from Nov 30 to Dec 4. He attended the workshop on its first two days (Monday, Nov 30 and Tuesday, Dec 1) of the workshop, since the talks on these two days, listed on http://www.theorie.physik.uni-muenchen.de/activities/workshops/archive_09/200911_30/index.html,
interested him most due to their connection with the AdS/CFT correspondence and defects in field theories. Attending this workshop also gave him the opportunity to discuss with D. Gaiotto, a known expert in the quantum dynamics of field theories, some open questions connected to my last paper (JHEP 0911:125,2009), in particular the form of the field theory of a certain codimension-one D3 brane in AdS4 x CP3.
A further purpose of the visit to Munich was to meet Dr. Johanna Erdmenger to discuss matters of ongoing joint research work between Dr. Erdmenger, and Prof. Kazuo Ghoroku (Fukuoka Inst. Tech.). For this purpose he stayed at the Max-Planck-Institute for Physics, where Dr. Erdmenger has her office, from Wed Dec 2 to Fri Dec 4. On Dec 4 he also presented a poster on his past research work (Phys.Rev.Lett.98:261301,2007) during the official evaluation of the "International Max Planck Research School", which is hosted by the Max-Planck-Institute and to which he was affiliated during his PhD studies there. He was invited for this poster presentation by Dr. Erdmenger.

Elias Kiritsis (16-23/12/2009), (1-13/1/2010), ENS and APC, Paris. Participation at the annual meeting for the selection of research fellows, together with representatives from the

Amsterdam, Paris. Israel, Imperial, and Munich groups. Visit of ENS, interactions with C. Bachas and J. Kurchan on disordered systems and G. Policastro on their holographic realization.
Visit at APC and collboration with F. Nitti on Relativistic Langevin evolution of heavy quarks in AdS CFT. Start of a project with D. Steer on the effects of turbulence in cosmology.

Matthew Lippert, trip to Geneva, Switzerland (25-29 January 2010). He attended the 2010 CERN Winter School "String, Supergravity and Gauge Theory" in Geneva, Switzerland. http://indico.cern.ch/conferenceDisplay.py?confId=58217 The school was held from January 25-29 and featured lectures on a series of topics including inflation in string theory, F theory model building, symmetries of gauge theory amplitudes, N=2 supersymmetric gauge theories, counting the microstates of black holes, and the current status of the LHC. In addition to the official program, he met his collaborator Niko Jokela and worked on his ongoing project involving a string theory model of the quantum hall effect. He also talked with Matti Jarvinen, about including him on the follow up project which is currently in its initial stages.

Elias Kiritsis (26-1-2010/3-2-2010) ENS Paris. Discussion with the director C. Kounnas on the organization of a formalized collaboration between ENS and Crete. Meeting with CNRS representative. Discussions on the preparation of the Cosmology Workshop in Crete. Collaboration with G. Policastro on disorder in AdS/CFT.

Theodoros Tomaras (29/1/2010-2/2/2010) ENS, Paris. The purpose of his visit to Paris during the period 29/1 – 2/2/2010 was (a) to collaborate with Professor G. Veneziano on issues related to bremsstralung radiation and black hole production in particle collisions, and (b) to collaborate with Dr. C. Bachas of the Ecole Normale Superieure (Paris) on topological solitons and brane models. These collaborations were fruitful and ongoing.

Ioannis Konstantinou, trip to Geneva, Switzerland (3-12 February 2010). Visit of the theory group at CERN. During his stay he had a collaboration with I. Antoniadis and T. Tomaras that was visiting at the same time. The topic was the energy loss from particles interacting at transPlanckian energies. He has attended the daily regular seminars of the theory group , in particular one by D. Forde on one loop calculations in QCD and S. Shatashvili on the quantization of integrable supersymmetric systems. This visit was very influential on research work at Crete.

Tsamis Nikolaos (4/2/2010 – 13/2/2010) Munich. During his visit to the Ludwig-Maximilians University of Munich during February 2010, he had scientific discussions with Professors Viatcheslav Mukhanov and Gia Dvali (who is in the process of moving from CERN To Munich) as well as members of the Cosmology group. The discussions centered around issues of post-inflationary dynamics in models that predict a phase of oscillations where all modes participate and not just the zero mode. As a result, the interesting possibility of relic gravitational waves from that era in the MHz range was seen as a test for their viability provided they would make

an observable contribution. He also gave a seminar on the subject of «Gravity-Driven Cosmology».

Elias Kiritsis (2-4/3/2010) Imperial College London. Lecture at the London triangular seminar on upcoming work on holographic description of strongly coupled condensed matter systems done in collaboration with B. S. Kim, R. Meyer, B. Gouteraux and C. Charmousis. Subsequent discussions and interactions on this subject with C. Hull, K. Stelle, E. Verlinde, G. Papadopoulos, and J, Gauntlet. Discussions with K. Stelle on the preparation of the September Conference in Crete.

Elias Kiritsis (13-18/3/2010) Heildeberg. http://www.tphys.uni-heidelberg.de/~emegias/string.html Coordinated participation with Johana Erdmenger from Munich as the two main lecturers in a workshop organized in Heildeberg for the ourpose of explaining to researchers the recent work of the Crete and Munich groups on the holographic description of physics of glue and mesons in QCD.He has given three hours of lectures on improved holographic QCD and Erdmeger another three on mesons in the D3-D7 system. Important interactions with A. O Bannon and J. Zaanen on AdS/CFT applications to condensed matter systems, K. Kajantie on applications to technicolor, A Hebecker on applications to 5d unified models of the RS type, and Marco Panero , on lattice calculations of stress tensor correlators. Setup of a collaboration in the latter case.

Tsamis Nikolaos (13/3/2010 – 20/3/2010) CERN, Geneva. During his visit to CERN, he had scientific discussions primarily with Professor Ignatios Antoniadis but also with other members of the Theory Division. The discussions started on the subject of cosmological dynamics but soon moved, unexpectedly, to the issue of which quantum effect, if any, is dominant with respect to the evolution of the universe. There was no complete agreement on the issue. The strengths and weaknesses of two prime candidate effects were analyzed: the energy density and pressure induced by infrared real particle production and the conformal anomaly contribution. He was also able to write about half-way a paper on the subject of « Tensor Perturbations and Newton's Law in Gravity-Driven Cosmology».

Zhang Hongbao (21/3/2010 – 28/3/2010) Trieste. Hongbao Zhang participated at the ICTP spring school http://cdsagenda5.ictp.trieste.it/full_display.php?ida=a09137 at the recomendation of de Boer and E. Verlinde from Amsterdam who where main lecturers. This is one of the top European schools in the field. Besides attending the lectures, Hongbao Zhang involved himself into discussions with the lecturers and participants. In particular, he discussed with C Csaki the possibility to use AdS/CFT to calculate some TeV scale physics from Randall-Sundrum model, with J deBoer the geometric description of near horizon limit, with E Verlinde whether it is possible to give an entropic force interpretation for all other forces. Last

but not least, inspired by Y Zhang's scattering amplitude talk, Hongbao Zhang was trying to prove BCJ relation via spinor-helicity technique.

Elias Kiritsis (12-15/4/2010) Munich. Participation at the meeting "Fundamentals of Gravity" http://www.universe-cluster.de/fog organized jointly by APC and Munich groups. Many top of the field were present. He presented his latest work with Crete researchers on static spherically solutions of Horava Lifshitz gravity both in the old and new formulations by Blas, Pujolas and Sibiryakov . He has extensive interactions with Horava, Pujolas, Sibyryakov, Dvali, Defayet and Khoury on gravity issues both in the Horava-Lifshitz case and in standard cosmology.

Elias Kiritsis (24/5/2010-5/6/2010) Paris-CERN (Geneva). Visit ENS, Paris, seminar on recent and ongoing work on holographic applications to condensed matter physics, discussions with G. Policastro, C. Kounnas, C. Bachas, V. Kazakov. Participation at the Planck conference at CERN where he gave a talk, on recent ongoing work, on emerged gravity in QFT. Discussions with I. Antoniadis, F. Zwirner, A. Hebecker, F. Quevedo, M. Quiros, A. Sibiryakov, L. Randal, A. Sundrum, T. Gherghetta.

Bom Soo Kim (12/6/2010 - 19/6/2010), Madrid, Spain. In Madrid, he took part in the workshop "XVIth European Workshop on String Theory 2010", which was held at the Real Jardın Botanico, Madrid, June 14-18 2010. The purpose of this trip was to learn recent progresses in string theory, especially the AdS/CFT and various applications of it, such as condensed matter system. He gave a talk with title "Charged Dilatonic Black Holes and Their Transport Properties" on June 17. This talk is based on the recent paper arXiv:1005.4690. During the workshop, he had chances to discuss the application of the recent work with Jan Zannen, who is condensed matter theories. He also discussed the Schrodinger spacetime with Jelle Hartong, Blaise Rollier who worked with the Schrodinger space and the field theory on the space.

Lippert Matthew (12/6/2010 - 19/6/2010), Madrid, Spain. . Event coordinated by Stelle (IMperial) Lust (Munich) Dvali (CERN), Verlinde (Amsterdam). He attended the 16th European Workshop on String Theory organized by the European Marie Curie Research Training Network "Constituents, Fundamental Forces and Symmetries of the Universe". The meeting, which was jointly run by the Institute of Theoretical Physics IFT-UAM/CSIC (Madrid) and the theory group at the University of Oviedo, was held in Madrid, Spain from June 14-18, 2010. This workshop covered a wide range of topics in string theory and was intended to foster communication and collaboration both within and outside the network. At the meeting, he presented a talk entitled "A Holographic Model of the Quantum Hall Effect" about his recent paper of the same title. He had informal discussions with many of the other participants including Veronika Hubeny (Durham), Lance Dixon (SLAC), Diego Rodriguez-Gomez (Queen Mary), Magdelena Larfors (Munich), in particular Jan Zaanen (Leiden) who shared much of his condensed matter wisdom.

Meyer Rene (13/6/2010 -19/6/2010), Madrid, Spain. Event coordinated by Stelle (IMperial) Lust (Munich) Dvali (CERN), Verlinde (Amsterdam). He took part in the workshop "XVIth European Workshop on String Theory 2010", which was held in the conference center "Real Jardin Botanico" in Madrid. The purpose of this trip was to keep himself updated on the recent research development in the field of string theory in Europe by listening to the presentations of research results, presenting his own work in a talk, and through discussions with the other participants (see below). He gave a talk with the title "Charged Dilatonic Black Holes and their Thermodynamics", reporting results of a recent research paper "Effective Holographic Theories for low-temperature condensed matter systems" (ArXiv: 1005.4690) which emanated from a collaboration with Bom-Soo Kim and Elias Kiritsis (University of Crete), as well as Christos Charmousis and Blaise Gouteraux (Univ. Paris-Sud).

Kofinas Georgios (13/6/2010-21/6/2010), Israel. He visited on 13-18/6/2010 the Center of Excellence in High Energy Physics, and its several campuses. In particular he visited the Physics Department of the Ben-Gurion University of Negev in Beer-Sheva, where he collaborated with Aharon Davidson and Eduardo Guendelman. With A. Davidson he worked on a six-dimensional Gauss-Bonnet brane-gravity model employing novel matching conditions, the so-called Dirac matching conditions, introduced in gr-qc/0606098 and further investigated in hep-th/0702010. The hope is that this way a unique 4-dimensional cosmology can arise which is not the case when conventional conditions are used. With E. Guendelman he started investigating the realization for a brane theory of implementing an alternative to the standard geometric measure arising as a natural measure from the brane embedding fields, proposed firstly in gr-qc/9905029. Moreover, during his stay at the Department he gave a talk with title `Transplanckian bremsstrahlung and black hole production`. Additionally, he visited on 19-21/6/2010 the Racah Institute of Physics at the Hebrew University of Jerusalem, where he interacted with Barak Kol and Eliezer Rabinovici on perturbative techniques for the gravitational radiation problems.``

Elias Kiritsis (30/6/2010-9/7/2010) Amsterdam -Paris. Participation at the Amsterdam summer workshop and seminar on the work of holographic applications to condensed matter physics. Discussions with J. De Boer, C. Skenderis, M. Taylor, K. Papadodimas, U. Danielsson, M. Douglas, S. Shenker, J. Mc Greevy, S. Hartnoll, B. Craps and I. Papadimitriou. Discussions on bilateral exchanges were also made with Director E. Verlinde. Subsequently he participated in the String Pheno 2010 meeting in Paris where he gave a seminar of his ongoing work on emerged gravity in QFT and the SM. He discussed physics with M. Cvetic, B. Schellekens, A. Sagnotti, K. Intriligator, E. Dudas, S. Abel, E. Iancu, F. Nitti, M. Bianchi, G. Shiu.

Iatrakis Ioannis (6/7/2010 - 27/7/2010), APC, Paris. He visited APC (Astroparticule et Cosmologie, Universitè Paris 7) in Paris, where he collaborated with Francesco Nitti and Elias Kiritsis. He worked on the calculation of fermionic two-point functions in asymptotically AdS spacetimes. In particular, he examined the case of fermions in the effective holographic backgrounds, which were proposed in hep-th/[1005.4690]. In addition, he continued working on a holographic model for the description of the mesonic sector of QCD. This model is based on Sen's action for a pair of a brane-anti brane. In particular, he worked on the features of the model in finite temperature. The Schrödinger potentials for the excitations of the fields were calculated and it was concluded that in finite temperature

there are no bound states in the model. This was also verified by the computation of the spectral function of the vector field excitations.

Elias Kiritsis (18/7/2010-7/8/2010) CERN-Geneva. Visit to CERN, seminar at the exprimental Group of ALICE experiment, in the Heavy Ion forum, on recemt work done in collaboration with F. Nitti from APC, on the Langevin diffusion of heavy quarks in holographic theories close to QCD. Discussions with I. Antoniadis, G. Dvali, C. Sfetsos, U. Wiedemann, Y. Foka. Seminar at the CERN theory group on holographic theories of condensed matter physics and their applications done with the group in Crete. Collaboration with I. Antoniadis and I. Papadimitriou.

Niarchos Vasilios (21/7/2010 - 28/7/2010) Paris. He is a senior Researcher at the CCTP. He visited ENS and participated at the international conference on High Energy Physics in ARISF and gave a lecture with the title “Towards a novel description of flavor dynamics in holographic QCD.#

Hongbao Zhang (25/07/2010-07/08/2010) Munich. He attended the international school on strings and fundamental physics. String basics and recent developments in string theory are covered in this school. Hongbao Zhang kept asking questions to grasp these lectures during the whole school. Meanwhile, he consulted Dam Son for some comments on his own research project related to optical properties of holographic superconductors.

Elias Kiritsis (8/8/2010-22/8/2010) Schrodinger Institute Vienna. Coordinated participation at the ESI Programm on AdS holography and the quark gluon plasma together with J. Erdmenger, O'Bannon (Munich), O. Bergman, G. Lifshytz (Israel), J. Casalderrey-Solana (CERN), E. Iancu (Paris). Workshop with intense interactions where recenmt progress in the field has been debated. He gave a seminar on his recent work on Langevin evolutions of heavy quarks in non-conformal holographic theories. He discussed physics with Erdmenger, O'Bannon , O. Bergman, G. Lifshytz, E. Iancu, I. Klebanov, L. Yaffe, Y. O. Yee, K. Kajantie.

Tassos Petkou (16/8/2010 – 29/8/2010) CERN, Geneva. He visited CERN in Geneva to collaborate with I. Papadimitriou (a coauthor on two papers) on Holographic renormalization and canonical transformations. From 30 Aug. to 3 Sep. 2010 he traveled to Rome as he had an invitation from Prof. M. Bianchi of the University of Rome "Tor Vergata" for collaboration on Aspects of Higher Spin Gauge Theories.

Elias Kiritsis (22/8/2010-8/9/2010) CERN-Geneva-Paris. Participation at the Heavy Ion Institute at CERN where the leading experts from theory and experiment on quark gluon plasma have gathered to debate the first LHC results from ALICE and upgrade predictions for the LHC experiments. He gave a seminar on his recent work on Langevin evolutions of heavy quarks in non-conformal holographic theories. He interacted with severak of the participants, notably, U. Wiedeman, J. Casaderrey-Solana, E. Shuryak, B. Muller, C. Ratti, D. Mateos, K. Eskola, K. Kajantie.

Constantinou Yiannis (29/8/2010-5/9/2010), Corfu, Greece. He took part in two schools, «School and Workshops on the Standard Model and Beyond - Cosmology» and «School and Workshops on Fields and Strings: Theory-Cosmology-Phenomenology», which were

coordinated by partners I. Antoniadis (CERN), I. Bakas (adjoint member of the Center), C. KOunnas (ENS), D. Lust (Munich). The purpose of this trip, was to gain important knowledge, related to high energy physics. During the first week, he had a chance to see a review of the Standard Model(SM), the experimental data that verify it, as well as the basic problems that it does not solve, leading to extensions beyond the SM. He also had some lectures about the first experimental results of the LHC. In the second school, there was a presentation of the inflationary model of cosmology, supersymmetry and an introduction to string theory.

Hongbao Zhang (31/08/2010-08/09/2010) Vienna. Coordinated participation at the ESI Programm on AdS holography and the quark gluon plasma together with J. Erdmenger, O'Bannon (Munich), O. Bergman, G. Lifshytz (Israel), J. Casalderrey-Solana (CERN), E. Iancu (Paris). He attended the AdS/QCD program in Vienna. He also gave a blackboard talk about his recent work on holographic superconductors after Prof. Policastro's related talk. In that talk, Hongbao Zhang concluded with his recent unpublished discovery of holographic laser, which attracted many attendees.#

Elias Kiritsis (24/9/2010-27/9/2010) Paris. Visit to APC, colaboration with F. Nitti, on the general holographic description of Langevin diffusion. Participation in the PhD committee of B. Goutereaux, collaborator and new junior member of APC.
Disscussions with P. Binetruy on the LISA Mission

Kofinas Georgios (27/9/2010-2/10/2010), France. He visited the Laboratory of Astroparticles and Cosmology (APC) of the University Paris 7, where he gave a talk with title “Gravitational bremsstrahlung in transplanckian collisions”. During his stay at the Laboratory, he collaborated with D. Langlois on the problem of non-linear perturbations in braneworld cosmology based on the method of covariant non-perturbative techniques successfully realized in standard four-dimensional cosmology, first introduced in astro-ph/0503461, astro-ph/0509078. Maybe the application of this technique could overpass some of the known technical and conceptual problems met in conventional linearized perturbations on braneworlds. Additionally, he visited the Laboratoire de Physique Theorique of the Univ. Paris-Sud 11 at Orsay, where he discussed with C. Charmousis on the development of the consistent six-dimensional Gauss-Bonnet brane-gravity approach introduced in hep-th/0907.1640 to the direction of relaxation of the axial symmetry ansatz to involve more general geometries.

INCOMING VISITS

Paris Sphicas , (11/6/09-14/6/09). He visited the Crete Centre for Theoretical Physics (CCTP), and gave several lectures on the process of LHC development and the CMS preparations. He discussed the new physics that will be explored with the CMS detector, and the current preparations and calibrations. He has also given a public talk in Heraklion in order to boost the public image of Particle Physics and inform the public on the current work at CERN.

Stavros Katsanevas (11/6/09-14/6/09). He is a senior APC member and vice director in CNRS responsible with astroparticle physics. He has given a seminar focused on current large international projects in astroparticle physics and cosmology and their expected impact. Possible collaboration agreements with ENS on research and education have been discussed. He has also given a public talk in Heraklion in order to boost the public image of AstroParticle Physics and Cosmology and inform the public on the new projects in cosmology as well as what we have learned in the past ten years.

Jean Iliopoulos (12/6/09-14/6/09). He has visited the CCTP for a few days and gave a seminar on his recent work on the large N expansion. Prof. Iliopoulos is also a member of the Advisory committee and several issues having to do with the program and the general

evolution of CCTP were addressed. Possible collaboration agreements with ENS on research and education have been discussed. He has also given a public talk in Heraklion in order to boost the public image of Particle Physics and inform the public on the theoretical advances of particle physics in the last thirty years.

Liuba Mazzanti (4/10/09-30/10/09). Mazzanti is a young researcher that works in the area of AdS/CFT and applications to QCD and the physics of quark gluon plasma. She collaborated with members of CCTP on the calculation of Langevin dynamics of heavy quark probes in quark gluon plasma using non-conformal holographic models for QCD.

Pascal Anastasopoulos (8/10/09-9/11/09). Anastasopoulos is a young research that works in the area of string Phenomenology. He has collaborated in the past with CCTP members. During his visit he gave several lectures and a seminar on mass hierarchies in orient fold models. He interacted with CCTP members and students and started collaboration on the search of special configuration orient fold vacua prone to implement properly mass hierarchies.

Bert Schellekens (12/10/09-29/10/09). Bert Schellekens is a senior scientist working on string theory and string phenomenology. He gave a seminar on his recent work of heterotic vacua constructed from Gepner models and the related issue of chirality.
He discussed new approaches with CCTP members on the implementation of heterotic algorithms and other issues.

Kyriakos Papadodimas (18/10/09 -31/10/09). Papadodimas is a junior scientist that is working in the area of string theory and the AdS/CFT correspondence. He has given a seminar on his latest work of topological-antitopological fusion in 4d N=2 CFTs, where he managed to derived the analogous equations for chiral correlators. He has also interacted with several of the CCTP members on issue related to the holographic description of neutron stars, as well as the abstract recognition of CFTs having AdS duals in 2 and 3 dimensions.

Jorge Casalderrey-Solana (27/10/09-2/11/09). Casalderrey-Solana is a junior member of the CERN Theory group. He has worked extensively in applications of AdS/CFT to heavy ion physics at RHIC together with Teany. He has given a seminar on his recent work on the langevin dynamics in N=4 Superyang Mills. He has also interacted with several CCTP members with common interests on several issues ranging from the calculation of Polyakov loops in holographic models of QCD, as well as issues related to the QCD Theta angle.

Thomas Sotiriou (2/11/2009-6/11/2009). Dr. Sotiriou visited the Center and gave a seminar on his recent work on Horava Lifshitz gravity. He described general actions that can be compared with data, as well as the strong coupling problems that emerge in this theory. He also described a two-derivative analysis of the modified theory arguing that the strong coupling problems persist. He interacted with group members on the issues on Horava Lifshitz gravity and its UV completion.

Angel Paredes (9/11/2009-12/11/2009). Dr. Paredes visited the Center and gave a seminar on his recent work on flavor corrections to QGP observables. This is a very topical subject and this has been one of the most interesting recent works on the subject. He has also discussed with Center members on how this can proceed to establish a fully back-reacted solution to the flavor problem. He has collaborated also with center members towards establishing a simplified model of flavor based on Sen's tachyon action.

Giorgio Torrieri (10/11/2009-17/11/2009). Dr. Torrieri visited the center and gave two seminars on his recent work. One was for the regular Tuesday seminar where he presented ideas on how a large bulk viscosity contributions can affect QGP data and mend some discrepancies that exist with HBT measurements. Dr. Torrieri gave also an informal presentation on his work on turbulence in HIC based on RHIC data. He has interacted with Center members on several other issues, in particular the issue of finite nuclear density and an intermediate phase in QCD.

Daniel Elander (26/11/2009-28/11/2009). Dr. Elander visited the Center and gave a seminar on his recent work on light scalars that emerge in holographic theories with "walking " behavior. This is important work as it gives clues to how viable strongly coupled theories can generate realistic electroweak symmetry breaking. He has also interacted with members of the group on issues of the calculation of scalar glueball masses in holographic backgrounds.

Sergey Sibiryakov (1/12/2009-5/12/2009). Dr. Sibiryakov visited the center and gave a seminar on his recent work on modifications of Horava-Lifshitz gravity. The original proposal in both its incarnations suffered from strong coupling problems. The new proposal avoids this. He explained the phenomenological tests and has many interactions with Center members on this subject, in particular in issues of observability of such modifications of gravity.

David Mateos (7/12/2009-12/12/2009). Prof. Mateos visited the center and gave a seminar on his recent work on universal predictions from AdS/CFT for QGP data. In particular he discussed a peak in photo production due to unusual velocity properties of mesons, as well as the Cerenkov radiation of mesons from heavy quarks and argued that these may be observable. He interacted with group members on issues of holographic duals of QCD, as well as applications to gravity.

Dr. Pascal Anastasopoulos visited the Crete Center of Theoretical Physics from 19/4/2010 - 14/5/10. He gave a seminar on his recent papers and collaborated with Mr. Elias Kiritsis on issues of model building in orienmtifolds. He also discussed with members of the centre.

Dr. Blaise Gouteraux visited the Crete Center for Theoretical Physics from 24/4/2010-6/5/2010 for the purpose of collaborating on an ongoing project on holographic theories for condensed matter physics. The paper will come out soon. Collaborators, Elias Kiritsis, Bom Soo Kim and Rene Meyer from Crete and Christos Charmousis from Orsay.

Dr. Vladimir Kazakov, professor of Paris University and researcher in Ecole Normale Superieure, visited the Crete Center of Theoretical Physics from 26/4/10 to 3/5/10. During his stay he gave a seminar to the Centre members on 30/4 and 3 unofficial speeches on his recent and pioneering work on Y-system for the solution of N=4 SuperYang Mills Theory.

Dr. Chris Kouvaris visited the Crete Center of Theoretical Physics of the University of Crete from 16/5/2010 to 22/5/2010. He gave a talk on his work on 19/5 and discussed with members of the centre on issues of technicolor interactions and cosmology.

Dr. G. Villadoro visited the Crete Center of Theoretical Physics from 17/5/2010 -22/5/2010. He gave a talk on 18/5 and discussed with members of the centre on issues of anomalous U(1)s. He started collaboration with E. Kiritsis and F. Zwirner on this issue.

Dr. Djordje Minic (2/6/2010 - 5/6/2010). He has visited the Crete Center for Theoretical physics and gave a seminar on his work on 4/6/2010. He has interacted with members of the group on subjects related to common interests.#

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Dr. Alexey Morozov (1/8/2010 – 21/8/2010) and Dr. Andrey Mironov (11/7/2010 – 21/8/2010). The purpose of the visit of Professors Andrey Mironov and Alexey Morozov to the Crete Center of Theoretical Physics (CCTP) was their collaboration with Professor Theodore Tomaras on Inflationary Cosmology. More specifically, a very important problem, which has attracted enormous attention in the last 30 years, is the question of instability of de Sitter spacetime, the arena of Inflationary Universe. Professor Tomaras has worked in the past on this subject, in collaboration with Professors J. Iliopoulos, I. Antoniadis and E. Floratos. In the last couple of years there has been revival of interest in this topic in new directions and with novel points of view. The purpose of the visits of the two professors from ITEP (Moscow) was the study and evaluation of these novel approaches. We would like to point out here that there is a six-year long collaboration of the group with professors Mironov and Morozov, which has led to a series of well known publications. As a result of their visit this time we have a first draft of our results, which we hope to finish and publish in their next visit to CCTP or Tomaras' next visit to ITEP.

Oz Yaron (19-24/1/10). He visited CCTP and gave a seminar on his recent work on holographic turbulence that is interesting and with potential. Several interactions ensued with E. Kiritsis, T. Petkou and the researchers in order to understand the range and applicability of the results. Several visits to Israel have been planned on the occasion.

Quiros Mariano (21-27/2/2010). He visited CCTP and gave a seminar on his recent work on RS geometries for the SM. His work is interesting and builds on perevious work by memebers of CCTP (E. Kiritsis and collborators). Discussions ensued with E. Kiritsis, T. Petkou and researchers on some of the rpoblems of this approach.

E. Saridakis (8-12/3/10). He visited CCTP and gave a seminar on his recent work on Horava-Lifshitz cosmology that builds on the related work by E. Kiritsis and G. Kofinas. Discussions

followed on the development of a project to analyze the observational consequences of the healthy extension of Horava-Lifshitz theory and in particular the related spherically symmetric solutions found earlier by E. Kiritsis. The project is ongoing.

Hermann Nicolai (18-24/3/10). Herman Nicolai visited the CCTP and gave a colloquium sumarizing progress in the past 10 years on the algebraic approach to symmetries in string theory and the Lorentzian groups associated with them. He has also given a seminar on his recent work on the subject. He interacted with all members of CCTP, especially the young ones on various topics as he is a very knowledgeable physicist.

Panero Marco (22-26/3/10)). He visited CCTP and gave a seminar on his recent work on

the high precision lattice evaluation of thermodynamic functions for YM with different values of the number of colors. His results have shown convincingly that there is little variation with N, and that they agree with previous theoretical work by the group. Discussions ensued where the issues were analyzed and a project has been set up to address stress tensor correlators in YM by combining lattice and holographic techniques.

Xi Yin (25-28/3/10) Hevisited CCTP gave a seminar on his recent work on higher spin gauge theories and holography. He has discussed related physics with members of the group and has collaborated with T. Petkou on related issues.

Fidecaro Francesco (14-16/4/10). He visited CCTP and gave a colloquium on the recent status and results of major gravitational wave experiments, around the world. He presented also the related projects for the future. He has interacted with all members of CCTP and an informal question/answer session was organized.

Panagiota Foka (4-13/5/10). Prof. Foka visited CCTP and gave a colloquium on the first results from the Alice Experiment (that were also the first experimental results at LHC). She is the second in command for the Physics at ALICE. This was an exciting session were the new results were presented and shown to disagree with basic Monte Carlo predictions. Implications for further results were developed. Prof. Foka gave also a seminar for CCTP where she described the physics of the QGP fireball as well as all the experimental observable. A long question /answer session ensued where CCTP researchers have learned all the intricacies of Heavy Ion experiments at LHC.

Barbon Fernandez Jose (2-6/5/10). He visited CCTP and gave a seminar on his recent work with E. Rabinovici on the holography of AdS vacuum bubbles. This is a very interesting and difficult topic and many discussions ensued between the speaker and E. Kiritsis, T. Petkou, T. Tomaras and the postodocs.

Ko Yumi (6-14/5/10). She has visited CCTP and gave a seminar on her recent work on including the gluon condensate in AdS/QCD. Discussions on the physics of flavor ensued and she interacted with several members of the group. A project has started where the introduction of extra interactions for the flavor vectors were included in order to get realistic physics at finite density from AdS/QCD.

Jarvinen Matti (12-19/5/10) He visited CCTP and gave a seminar on his recent work on holographic approaches to technicolor. Many discussions followed between E. Kiritsis, T. Petkou, and the postdics on these issues and an initial collaboration on including properly chiral symmetry breaking was setup.

O' Banon Andrew (9-13/5/10). He visited CCTP and he gave a seminar on his recent work on conductivities in holographic flavor brane systems that could have condensed matter applications. Many discsussions followed with E. Kiritsis, T. Petkou, M. Lippert, D. Yamada BS Kim and R. Meyer on the extension of this work to magnetised systems and non-backreacted sistuations. The work of the group was also discussed and put in context.

Woodard Richard (2/5 – 2/7/10). He has given a seminar on the zeta-zeta correlator during inflation and aother issues on quantum corrections during inflation. He has interacted with E. Kiritsis, T. Tomaras, H B Zhang and N. Tsamis ion the general issue of quantum corrections during inflation. He has started a collaboration with N. Tsamis.