

**Report on the  
CreteHEPCosmo  
Centre for Theoretical Physics**

**Conclusions of the Scientific Advisory Board Meeting  
November 18-19 2009**

**Members of the Board:**

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# 1 Executive Summary

The Scientific Advisory Board met at the Physics Department of the University of Crete in order to evaluate the scientific program of the Crete Centre for Theoretical Physics (CCTP hereafter)<sup>1</sup> during the week of November 16-20, 2009. The evaluation addressed the entire spectrum of the Centre's activities, scientific, educational and administrative. The financing for the Centre comes from the EU program *Research Potential*, which is part of the program *Capacities*. It is intended "...to enable highest quality or most promising research entities of significant size ... to become more integrated in the European Research Area". The current evaluation is being conducted six months into a three year grant and its purpose is not so much to evaluate scientific work already accomplished as to evaluate whether the 'initial conditions' for achieving high-quality scientific results over the next couple of years have been established.

Before the meeting we reviewed the initial report of the Centre and studied the Annex I of the contract. During our visit, we heard comprehensive presentations by the Coordinator as well as by several senior members and by the postdoctoral fellows. In addition, the evaluation committee met privately with the postdoctoral fellows and also with the graduate students working in the Centre in order to get a 'bottom up' view of how the Centre functions and to assess the degree of satisfaction of these junior personnel with their working environment and scientific opportunities. Finally, the evaluation committee reviewed the publication record of the postdoctoral fellows in order to develop an informed view of the level of scientific excellence of these key players in the scientific life of the Centre. On the basis of this input, and bringing to bear the personal expertise of the members of the Board in many of the areas of activity of the Centre, we came to the conclusion that the goal to create a vibrant centre of research in fundamental theoretical physics is achievable. The Centre has laid out a broad research program for itself, uniting particle physics, cosmology and certain aspects of condensed matter physics. This program is ambitious, but it has the kind of intellectual unity which makes it perfectly appropriate for a medium-size research institute such as this one. Success can be reasonably anticipated, given excellent leadership and the ability to recruit top-level personnel, conditions which we believe are met in this case. All in all, the committee judges that the Centre has made an excellent start toward achieving an ambitious

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<sup>1</sup>In the initial proposal for funding by the EU it was named *Crete Center for Particle Physics and Cosmology*, later changed to *Crete Centre for Theoretical Physics*.

and very worthwhile set of scientific and institutional goals.

The board was favourably impressed by the very good scientific level of the permanent members of the Centre and by the contacts which have been developed with experimental groups in atomic physics and condensed matter physics. The educational part is promising with a good initial group of postdoctoral fellows and beginning graduate students. The intellectual atmosphere appears to be stimulating. The Centre is well integrated into the Physics Department of the University of Crete and benefits from its technical infrastructure. The administrative support should be strengthened, if only to deal with the rather time-consuming procedures which have to be followed to authorize non-European citizens to visit or work in the Centre. This is important because a significant flux of non-European personnel is essential to the concept of the Centre's operations. Also, the rules and regulations of the EU Administration concerning the planning for and funding of scientific travel appear to be so rigid that, if applied blindly, they would be a handicap for the scientific development of the Centre. The Board strongly recommends a more flexible approach, in line with internationally established scientific practice.

The Scientific Advisory Board expresses its appreciation to the Coordinator and the members of the Centre for making our visit both as pleasant and as informative as possible.

## 2 Scientific Program

The goal of the Centre is to create a vibrant centre of research in fundamental theoretical physics, with special emphasis on applications of string theory to beyond Standard Model physics, cosmology, and even to parts of condensed matter physics. These topics are unified by the fact that they can all be addressed within a broad theoretical program, currently under intense development, known as gauge theory/string theory duality (sometimes called AdS/CFT). The resulting intellectual unity makes this a very suitable guiding program for a medium-size research institute such as this one. Most of the post-doctoral fellows hired into the Centre so far are expert in AdS/CFT technology and are well-suited to working cooperatively together in pursuit of the Centre's declared scientific program. Scientific exchanges and the hosting of topical workshops will also be important to maintaining scientific excitement in an institute located significantly 'off the beaten path'. In the light of this fact, the choice of the physics of AdS/CFT, one of the most active areas in contemporary fundamental theoretical physics, as the focus for the Centre is particularly wise. The Scientific Advisory Board considers the establishment of the European program *Regional Potential*, which finances this Centre, as an excellent initiative and the selection of this research group to benefit from this program as fully justified.

## 3 Strengthening the Research Potential

### 3.1 Faculty

The permanent faculty, consisting presently of eight members, is making a serious effort to hire a new permanent member (an offer to Prof. Kostas Skenderis having been eventually declined) and possibly a second one in a few years. While the primary criterion for such a hiring remains the absolute scientific standing of the candidate, an effort to recruit in the area of cosmological model building and phenomenology would complement best the present in-house expertise. At the junior faculty level Vasili Niarchos was successfully appointed (after a first offer to Dr. Marika Taylor had been turned down). Clearly the task of recruiting top class theorists remains a challenge and can only succeed if the Centre is able to maintain and even improve its high scientific standards.

### **3.2 Postdocs**

The post-doctoral program was increased considerably at the start of this Academic year with the hiring of four new young theorists. A fifth will arrive in January and a few more are expected to join for the next Academic year. The post-doctoral team looks very well integrated and very happy with the working conditions. Their profiles, although to some extent complementary, lead us to believe that their mutual interactions, as well as interaction with the faculty, will be very smooth and productive.

### **3.3 Graduate students**

A number of graduate students are presently enrolled in the subjects of interest to the CCTP both at the Master and at the PhD level. They appear to have good contacts and relations both with the faculty and with the postdocs of the Centre. It would be desirable to add to the one-year Master program a short but intensive crash course in order to prepare them to the PhD program and to actual research.

## **4 Personnel Exchanges and Twinings**

The Centre is implementing well its interactions with the nine ‘Twin Institutes’ appearing in the program. There is a constant inflow of visitors, some staying in the Centre for extended periods. This allows for a rather intense program of seminars (typically two per week) and for the easy establishment of external collaborations. The exchanges are also proceeding in the opposite direction with frequent visits of twin Institutions by members of the Centre. In this respect we think that an important improvement could be achieved by increasing the flexibility of the exchange program. Today’s research in theoretical particle physics and cosmology is such that its evolution cannot be predicted much in advance. This is also true, of course, for the results expected to arrive in the coming years from accelerator or astrophysical experiments. As a consequence, any attempt to provide a detailed plan for scientific exchanges well in advance, appears to the committee to be ineffective at best and counterproductive at worst. In this respect the EU Administrative Rules, which seem to require such advance planning, are likely to be a serious hindrance. In order to meet the Centre’s scientific needs, the exchange program has to be flexible enough to allow planning on a relatively short time scale. This is also necessary when new collaborations form, making it necessary for its members to meet on a short notice.

## **5 Organisation of Meetings**

The Centre has organised several meetings both at the national and at the international level and is planning to continue doing so in the coming years (two workshops are already planned for the spring and fall of 2010). It was felt that having at least one (and possibly several) general meeting of Greece-based theorists (not necessarily in Crete) would be very desirable.

## **6 Administrative Aspects**

In general the group is happy with the local infrastructure. Some improvement on handling the installation of new postdocs (particularly when coming from non-EU countries) would be desirable. This could be possibly achieved best by having a single person in charge of such matters for the entire Physics Department, or even the University. The visa and work permit problems are the same across the department and it would make sense, and lead to a gain in efficiency, to have one person deal with them full time.