

**PhD School of Physics
University of Trieste**

Scientific Council Meeting

REPORT OF THE SCIENTIFIC COUNCIL

December 2011

Scientific Council Report.

1. Introduction.

The objective of the present report is the evaluation of the progress and scientific activity of the PhD School of Physics during 2011. To accomplish this task the Scientific Council (SC) gathered in Trieste on 13th and 14th December 2011. The first day was devoted to the seminars of the last year PhD students who reported on their research work and were questioned by the Scientific Council members with the aim of understanding their independence and scientific maturity. On 14th December 2011 the Council gathered to write the present report which, besides the PhD students seminars, is based on the discussion of a series of documents provided by the School Director who also gave a report about the School activity during 2011. The documents examined are listed hereafter.

- List of the PhD students, their scientific projects and supervisors,
- End-of-cycle reports, XXIV cycle students,
- Year end reports, XXV Cycle students,
- Year end reports, XXVI Cycle students,
- XXIII cycle final exam committee reports,
- Referees' reports on XXIII cycle students thesis,
- List of students publications,
- Statistics about the employment status in the 5 years after graduation,
- Document prepared by the Evaluation Committee of the Trieste University,
- Results of a questionnaire to PhD students,
- Summaries of the thesis of the XXIV cycle students,
- Document prepared by the Director to start the new (XXVII) Phd cycle,
- List of publications of the Teachers board members.

2. General aspects.

The School presently has **31** students, evenly divided in each of the 3 cycles. Further 11 students successfully graduated during 2011. Such numbers have been rather stable in the past years.

The students of the PhD School of Physics at the Trieste University can benefit of a local environment which is very rich and stimulating. The School is in fact integrated in a research and higher education system which is rather unique. The PhD students can take advantage of the presence of several laboratories and institutions where they can perform their researches, develop collaborations, take highly qualified courses or participate to workshops and other scientific activities. In addition to the local ones, the students have also access to several other national and international laboratories where local research groups work.

The SC considers the richness of the Trieste scientific and educational system as an important and relevant ingredient for the quality of the phd studies and researches and encourages the

school to keep and strengthen the links with the different scientific realities present in Trieste. The fact that for the starting PhD cycle 6 fellowships have been financed by external organisms is considered as a positive indicator under this respect.

3. Variety of the scientific activities.

The wide spectrum of researches accessible at the School goes from activities in fundamental nuclear and subnuclear physics to the physics of electronic devices and new materials, from the development of new machines to medical physics, from nanotechnology to astroparticle physics and astronomy, from theoretical and computational solid state physics to quantum information theory. This is reflected in the below list of active projects.

Nuclear and Subnuclear Physics

- Measurement of two-hadron transverse spin asymmetries in SIDIS at COMPASS
- Measurement of the top-antitop production cross-section with the ATLAS experiment at the LHC
- Search for CP violation in two flavorless decays of the Bs meson at CDF
- Measurement of Deuterium and ^3He Component in Cosmic Rays with the PAMELA Experiment
- Measurement of Z boson and jets associated production in pp collisions with the CMS detector
- Study of the pile-up effect in Z+jet events in proton-proton collisions at the LHC
- Light hypernuclei production in Pb-Pb collisions at $\sqrt{s_{\text{NN}}} = 2.76$ TeV with ALICE at LHC

Medical Physics

- Speed and Imaging Capabilities of the PICASSO Detector

Astrophysics

- Study of structures formation and evolution in non-standard cosmological models
- Galaxy evolution by chemical and SED models
- Cosmic star formation history: multiwavelength analysis, theoretical predictions.
- Analysis and Characterization of Systematic Effects in the Study of the Cosmic Microwave Background Anisotropies with the Planck LFI instrument
- Metallicity effects on the SNIb/c and GRB rates in Irregulars and Spirals
- Photometric transit search for planets around cool stars from the Western Italian Alps: A pilot study
- The scaling relation between mass and velocity dispersion for simulated groups and clusters of galaxies
- Dark matter haloes and galaxies: semi-analytic approach and comparison with observations

Solid State Physics.

- Non-equilibrium phase diagram of Bi2212 cuprate superconductors revealed by ultrafast optical spectroscopy
- High Pressure Infrared Studies in Biological Systems
- Structural investigation of complex surface interfaces by means of X-ray photoelectron diffraction
- Mapping topological order in coordinate space
- Physical properties and functionalization of low-dimensional materials
- Structural and electronic properties of an organic donor-acceptor interface
- Implementation of algorithms related to phase sensitive techniques
- Static and dynamical XAS study of electronic and structural phase transitions in complex materials
- Ultra-fast time-resolved spectroscopy of strongly correlated materials
- Broad band acoustic spectroscopy in disordered systems
- Extreme thermodynamic conditions investigated by femtosecond pump-probe experiments

Theoretical Physics

- Models of spontaneous wave function collapse: mathematical and phenomenological analysis
- Fluctuations and entanglement in mesoscopic quantum systems

The SC considers the variety of scientific activities of the School as rich and well balanced among the different areas.

4. Students Training

The training of the students is achieved mainly via their integration, already from the very beginning of their activity, in highly qualified research groups working in a strongly competitive international context. There they learn the techniques, methods and approaches necessary to develop the skills needed to operate in an advanced scientific environment. They also have access and learn the use of advanced technological and computational instruments which, besides being the tools of their research, become skills that can be usefully spent later for a successful job search.

The SC considers this choice rather effective in achieving the School goals as witnessed by the high scientific level shown by the PhD students during their audition and confirmed by other indicators discussed later in the present document.

While the main part of their training is performed directly within their research activity during the 3 years of PhD, the courses are essentially confined to the first year. The students are offered specific courses focused on the areas of their doctoral theses as well as curricular courses. On top of this they must attend at least two national or international schools for PhD students and report,

the end of each year, in a public seminar about their research activity. The overall training activity appears adequate and effective to the Council.

5. Students scientific quality.

The impression deduced from the students' seminars is very positive, indicating a high level of competence and a research work of high profile which in most of the cases will most likely produce, where it has not already, one or more publications on international refereed journal.

One aspect which appears to still be in need of further efforts is the communication skills of some of the students and in particular their ability to communicate the basic reasons of their research to a wider, non specialist audience. The SC recommends the School to put a further effort on training and instructing the students on the relevance of their communication capabilities already from the first year of their PhD, stimulating also cross-area seminars in order to overcome what appears as a lack of experience in presenting their work.

Several other indicators were evaluated in order to assess the scientific quality of the students. The first is the report of the external, independent referees chosen on the basis of their scientific stature, to evaluate the PhD students work. The referees were asked to focus on the originality, quality and relevance of the performed research. The work of all the 11 students that graduated in 2011 was positively judged, with a final evaluation ranging from good to excellent.

This result is considered of primary importance being an independent and qualified evaluation of the PhD students scientific quality. The SC welcomes therefore the choice of assigning 2 referees to each student completing their studies in 2011 as a further strengthening of the quality control by the School.

Further elements taken into account by the present report are the scientific production of the students and the success in their job application after graduation.

While some students have already published one or more papers on international peer reviewed journals, others have not yet, but several articles are in their final stage or have already been submitted for publication. The SC considers this a good result, considering that many of the PhD researches have just been finalized.

As far as the job market is concerned the SC analyzed the results of a survey on the students that graduated in the past 5 years. The resulting employment rate is ~100% and in more than 90% of the cases the title is relevant to the present job. Moreover the majority of the former students is presently employed in renowned research organisms or universities in several different countries ranging from Europe to Australia, from South Africa to North America.

The CS considers this a striking result that indicates the high level of maturity and overall quality of the students graduating at the Trieste School.

6. Recruitment.

The yearly number of applications appears stable, although somehow smaller than in the past. This appears anyhow to be related more to a general trend than to a local problem, as witnessed by the fact that a large fraction of the students come from outside the regional basin.

The number of fellowships offered each year by the School is rather stable, with even a positive trend related to the capability of the School of attracting external funding as well as because of extra-fellowships awarded to the School because of its top ranking inside the Trieste University. Specific comments are due regarding the number of students coming from abroad, who presently amount to 10% of the students. The School has put a lot of efforts in the past years towards a more effective recruitment of students from abroad, but there are still several obstacles and problems to solve. The main ones are related to an awkward recruitment system which discourages applications, to a lack of funds to pay the candidates travel expenses and to fellowships that are too poor if compared to those of several other countries.

Such problems cannot be easily solved autonomously by the School, but are either peculiar to the Italian PhD system or their solution needs to be agreed with the Trieste University government bodies. In 2011 the School efforts focused on improving the applicants' evaluation which, in 2011, was based also on a teleconferenced interview. This resulted in clear improvement in the effectiveness of the recruitment. Although several problems are still to be solved, the SC appreciates the effort and encourages the School to keep working along this direction, since it will take some time to have a satisfactory recruitment system.

7. Teachers Board and supervisors.

The SC examined the scientific production of the Teachers Board and supervisors relative to the period 2006-2011. The average number of publications is above 30, all of them on refereed international journals of the highest level.

Based on the above analysis, the SC rates the scientific quality of the Teachers Board and of the supervisors as excellent.

8. Summary and Recommendations

The Scientific Council of the PhD School of Physics of the University of Trieste gathered in Trieste on 13th and 14th December in order to evaluate the progress and the scientific activity of the PhD School of Physics.

The Council work was based on the analysis of documentation provided by the School Director and on the participation of the Council to the the year-end seminars of the PhD students.

The SC had a very positive impression about the scientific quality and commitment of the students from their year-end seminars:

- The results of the research work presented were of high level, appeared to be well positioned in the international context of the respective area of research and witnessed a relevant effort and commitment.

- All the students were very focused on their work which they appeared to master with high competence, while their ability in communicating their results was not always as high.

The SC encourages the School to continue or even increase the frequency of students seminars, in a dedicated effort in improving the students communication skills

The school appears to be very successful and effective in inserting and integrating the students in research groups and activities, which happens from the very beginning of their PhD training. The students often play a relevant role inside the collaborations, contributing with originality to the existing researches or even contributing to start new lines of research.

The School commitment in reaching and maintaining a high scientific quality of its students is achieved mainly by the following actions:

- Requirement of high quality standards in the student selection phase
- High scientific quality of the supervisors, chosen also from the many other local scientific institutions, which have a key role in giving access to highly qualified expertise, technologies and national and international laboratories
- Close monitoring of the student training
- Choice of highly qualified referees to evaluate the students work (further strengthened by the use of 2 referees)

The SC praises the School for its continuous effort in maintaining and trying to improve the scientific quality.

The variety of researches in which the students are occupied is relevant and is an indicator of the health of the School.

Further confirmations of the scientific quality and maturity of the students are the number of publications on international refereed journals as well as a success rate close to 100% in the job market. School statistics on the PhD students, monitored for 5 years after graduation, show that in most cases the former students have succeeded in academic or scientific careers in national and international bodies.

The SC considers such results as a great success.

The School puts a sensible effort in improving the recruitment of international students, presently constituting 10% of the total. Even though the progress is slow, the SC encourages the School to persist in the effort since this important goal has to be considered as a medium term target.

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