



ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

**Α . Δ Ι . Π .**

ΑΡΧΗ ΔΙΑΣΦΑΛΙΣΗΣ ΠΟΙΟΤΗΤΑΣ

ΑΝΩΤΑΤΗΣ ΕΚΠΑΙΔΕΥΣΗΣ

HELLENIC REPUBLIC

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HELLENIC QUALITY ASSURANCE AGENCY

FOR HIGHER EDUCATION

## **EXTERNAL EVALUATION REPORT**

DEPARTMENT OF PHYSICS

ARISTOTLE UNIVERSITY OF THESSALONIKI

JANUARY 2011

### **External Evaluation Committee**

The Committee responsible for the External Evaluation of the Department of Physics of the Aristotle University of Thessaloniki consisted of the following five (5) expert evaluators, drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005:

1. Prof. Costas Kounnas, École Normale Supérieure, CNRS, France (Coordinator)
2. Prof. Christos Flytzanis, École Normale Supérieure, CNRS, France
3. Prof. Panos Razis, University of Cyprus, Cyprus
4. Prof. Charalambos Tsertos, University of Cyprus, Cyprus
5. Prof. Emmanuel Tsemmelis, European Laboratory for Particle Physics, Switzerland and University of Oxford, United Kingdom

*The structure of the “Format” proposed for the External Evaluation Report is dictated by the requirements of Law 3374/2005 and corresponds generally to the structure of the Internal Evaluation Report submitted by the Department.*

*The length of text in each box is free. Moreover, the various questions may not be answered separately; they only provide a general idea about specific matters that should be addressed by the Committee when formulating its comments.*

### **Introduction**

- The External Evaluation Committee (hereafter referred to as the “Committee”) visited the Department of Physics (hereafter referred to as the “Department”) of the Aristotle University of Thessaloniki between the 24<sup>th</sup> and the 26<sup>th</sup> of January 2011.
- In the afternoon of the 24<sup>th</sup> of January, the Committee had an introductory meeting at the University with its Vice-Rector for Academic Affairs, Professor D. Lialiou, in the presence of the Head of the Department of Physics, Professor C. Manolikas, and the Chairman of the Internal Evaluation Committee, Professor S. Bes. A series of questions were asked by the members of the Committee for further clarification of the elements of the review.
- The Vice-Rector for Academic Affairs provided a general qualitative and quantitative overview, including the educational, research, economic and administrative elements characterising the University.
- The Dean of the Faculty of Science, Professor S. Pavlides, and the Chairman of the Department, Professor C. Manolikas, presented the activities of the Faculty of Science and of the Department, including a number of statistical elements concerning educational and research numbers, budgeting, student performance statistics, age distributions, planning elements etc.
- The Chairman of the Internal Evaluation Committee, Professor S. Bes, presented the findings of the internal evaluation process, including a number of statistical elements concerning educational and research numbers, budgeting, student performance statistics, age distributions, planning elements etc.
- The undergraduate and graduate programmes were presented by members of the Department, G. Stergioudes, M. Aggelakeris, and T. Laopoulos. Some elements concerning the practical training for future professional placement were also presented.
- The Head of the Secretariat of the Research Committee, G. Petridou, gave a short presentation concerning the research programmes and their funding structure.
- Faculty members in charge or their representatives presented the educational and research activities of each scientific sector of the Department.
- Together with representatives from the Department, visits were made to the principal educational and research laboratories of all Sections.
- Presentations and visits were made of the activities of the technical and administrative personnel, including the Department Secretariat, Physics Library and Information Technology services.
- Meetings were held with young faculty members, Lecturers and Assistant Professors.
- Meetings were held with administrative/research/teaching/technical support and service personnel (ΙΔΑΧ, ΕΤΕΠ, ΕΕΔΙΜ ΙΙ).

- A discussion was made with student representatives (graduate and undergraduate), in particular on aspects related to the educational processes at the University/Department, the student support system, the student performance and related problems.
- During the visit short discussions were occasionally made on the outreach activities and knowledge transfer from the Department to industry and the local society in general.
- Finally, closed sessions took place for the Committee members to consider and check all the information collected, to evaluate the Department and to write the External Evaluation Report.
- During the 3-day visit to the Department, some discussions were also held with various members of the Department at the individual level.
- For the evaluation of the Department of the Aristotle University of Thessaloniki, the members of the Committee received and took into consideration the information contained in the following documents:
  1. The Internal Evaluation Report, including the tables and annexes concerning the personnel and curriculum and an analytical departmental publications list for the period 2003-2009.
  2. Undergraduate and graduate studies curriculum handbook.
  3. Presentations and digital material provided by the Head of the Department, Head of the Internal Evaluation Committee and heads of every Section.
  4. Additional material, including brief presentations, by the responsible of the teaching and research laboratories.

## **A. Curriculum and Teaching**

### **A1.1 Curriculum: Undergraduate level**

#### **APPROACH**

The undergraduate physics curriculum is based on 4 years of study. The Bologna Process has not yet been implemented. The core undergraduate physics curriculum, although being apparently inspired by international undergraduate teaching programmes, is however structured on a general level on the experience and traditions of the Department over the years.

More specifically, the undergraduate physics curriculum consists of a complex and overloaded combination of courses according to the following scheme:

1. 36 mandatory courses, 2 elective courses of general nature and 13 elective courses are offered (introductory and main physics courses, 6 fundamental mathematics courses, 1 general chemistry course, 1 computer course, 7 physics laboratory courses, 1 foreign language course, 1 history of physics, and elective courses in 9 specialization areas).
2. The 13 out of 81 elective courses offered are taken in the following areas:
  - Astronomy,
  - Nuclear Physics and Particle Physics,
  - Theoretical Physics,
  - Solid-state Physics,
  - Materials Science and Technology,
  - Electronics and Telecommunications,
  - Atmospheric and Environmental Physics,
  - Applied Physics,
  - Computational Physics,
 and 33 additional courses are also offered in interdisciplinary fields together with other Departments.
3. A Diploma Thesis is offered as an elective course in all the above areas.

The minimum number of didactic units to obtain the final undergraduate degree (*Πτυχίον*) is 169, corresponding to 248 ECTS units.

The Committee considers that the undergraduate programme is significantly overloaded and fragmented and with an exceptionally high number of courses offered, resulting in demoralizing and discouraging the students, which is reflected in unacceptably high study period (with an average of 6.3 years to graduate, with a high variation and with only about 6% completing their studies within the standard 4 years) and difficulties in their subsequent professional placement. This introduces uncontrollable running costs to the university.

The Committee also finds that the high number of elective courses is excessive compared to what is offered in other universities in Europe/USA and leads to a

programme of study, which is too broad, and without concrete professional scope. This results in a programme of study, which does not prepare students for subsequent career training and placement. In addition, it affects the number of students that are retained for further graduate study.

The undergraduate programme is not adequately supported by exercise classes. This is due to the high number of courses to support and that there is an insufficient number of corresponding staff to support this number of exercise classes.

Furthermore, in general, the undergraduate courses are fragmented, as each course is split into multiple classes with different lecturers. This results in differing course material and examinations, which do not test fully the same material.

The Committee was informed that the student attendance is exceptionally low and drastic measures have to be undertaken urgently from the Department's side to change this unsatisfactory situation. This is principally due to the long-standing practice that, in most cases, the students are not being continuously evaluated with intermediate examinations, but only through a single examination at the end of the course.

Moreover, it is also exceedingly alarming that the majority of all the enrolled students (currently about 3500) are considered to be "students under degree" («φοιτητές επί πτυχίο»), who attend only the final examination periods and attempt to pass a course by only sitting the final examination. This is anti-pedagogical and totally discouraging for the good students, since in most cases a "student under degree" passes a course, which actually might have been delivered some years ago by another lecturer and with different content. In this way, the university instead of promoting teaching and education abilities to the students – being one of its important missions – rather resembles a large examination centre producing higher-education degrees. It is clear that the value of such degrees is highly questionable for the future of the students themselves and for the Greek society in general. (Concerning this point, the Committee is well aware that this unacceptable situation is rather common in the Greek university system.)

The undergraduate teaching laboratories are numerous and cover the standard needs of an undergraduate programme.

### ***APPLICATION AND RESULTS***

The overall structure of the physics undergraduate curriculum is neither well developed nor balanced. This is due to the large number of core and elective courses. The curriculum should be restructured. This can be done by drastically reducing the number of courses offered and taken. More specifically, the Committee recommends that the number of core courses should be reduced to 32, which can be achieved by reducing 1 course per semester. Moreover, the number of elective courses should not exceed 4 to 5 courses per specialization area, which means that the elective courses must not exceed about 40 in total. The reduction process must be accompanied by consequent improvement in cohesion and depth according to international standards. The resulting structure will improve the quality and content of the programme.

The Committee also stresses the importance of introducing a final-year project in the fourth year of study (Diploma Thesis) that has to be mandatory and to last two full semesters. This helps students develop and enhance their own initiatives and introduces them to research and/or to a professional career.

During its visit to the Physics Department the Committee received a new version of the undergraduate physics programme, which is currently under discussion within the various decision-making bodies of the Department. The Committee finds that this new version is, with only a small reduction in the number of elective courses, nearly identical to the current undergraduate programme. Therefore, Committee's proposal for a drastic reduction in the number of courses made for the current undergraduate physics programme is also valid to this new version under discussion. The Committee further believes that the course on "Introduction to Atmospheric Physics" should not be placed in the mandatory core programme and should be moved to the departmental elective courses.

The undergraduate teaching laboratories must be refurbished and brought up to modern standards in equipment and safety. The allocated space for the laboratories is adequate but its presentation must be improved to create an attractive teaching and learning environment. As far as the infrastructure for the undergraduate teaching laboratories is concerned, the Committee feels that the infrastructure is very well organized, preserved in very good condition and located in adequate space. The Committee underlines that measures should be taken for the continuous refurbishing and maintenance of the teaching laboratories in order to preserve their present excellent state, to further expand the laboratories to provide more possibilities and to upgrade the experimental set-ups. However, there is a serious lack of a sufficient number of specialized technicians. The present situation, with primarily only unpaid graduate students covering the needs of so many student groups in several educational laboratories, is not satisfactory.

Although the Committee would prefer a natural order for a student to attend the courses of the physics programme, the Committee appreciates, however, that the prerequisites cannot be strictly enforced, due to the varying rate of progress of each student. Therefore, the Committee recommends that the Department encourages the students to advance in their courses once they have been exposed to the prerequisites, even if they did not successfully pass the previous courses containing these prerequisites.

Therefore, a major priority should be taken in the recruitment of specialized technical personnel, together with a solution of providing stipends/fellowships to graduate students through teaching assistantships in order to help run the experimental exercises.

### ***IMPROVEMENT***

The Committee considers that priority should be given to recruiting new specialized technical personnel to guarantee the quality and continuous functioning of the experimental courses due to large number of students sharing the same experimental set-ups. A further solution can be provided regarding this issue by granting teaching assistantships to young graduate students (preferentially PhD students) who also provide invaluable contributions to the faculty members in their research programmes.

The constant maintenance and upgrade of the infrastructure of the teaching laboratories should not be neglected, including the hardware equipment, software, computing systems and networking. The recruitment of specialized technicians is necessary.

It is common international experience that a student can be enrolled only in a certain number of courses at the beginning of each semester. The student is then obliged to attend the course, to participate in homework or class work (laboratories), to attend the mid-term examinations, etc. After fulfillment of all these requirements, the student can then participate in the final examination, irrespective of whether it is the first time or after multiple attempts. The Committee realizes the difficulty of implementing this procedure, given the current pool of “students under degree”, but this should be seriously considered by the Department in the future re-organization and re-structuring of the universities.



## **A. Curriculum and Teaching**

### **A1.2 Curriculum: Master and Doctoral level**

#### **APPROACH**

The Department has 5 graduate programmes in Physics. Despite the fact that the Bologna Process has not yet been implemented an effort has been made to ensure that the programmes have been adapted according to the respective guidelines for Master and Doctorate degrees. All courses have been recently credited according to the ECTS system.

There are 4 postgraduate Master study programmes (*Μεταπτυχιακά Προγράμματα Σπουδών, ΠΜΣ*): Electronic Physics (*Radioelectrology*); Environmental Physics; Materials Science and Technology; and Computational Physics. There is also one inter-departmental course – Nanoscience and Nanotechnology – in collaboration with the Departments of Chemistry and Biology and the General Department of the Polytechnic School (Πολυτεχνική Σχολή) of the University. Each programme has duration of three-to-four semesters, including one semester for the Master's thesis. The evaluation of the Master programmes is based on the courses and on the Master's thesis. All graduate programmes of the Department offer doctoral programmes.

There is a very limited number of scholarships available to support students studying under these Masters programmes. This includes scholarships from the national IKY Foundation and from European/national programmes, such as HERAKLEITOS, which however, has considerable delays in approving and delivering its funding creating unbearable study conditions for the students.

The Masters programmes are planned according to the research interests of the individual laboratories as well as the didactic orientation of the Department. Some are of good quality and are comparable to the level of Masters programmes offered by other universities in the world. Most of the topics are of applied nature, and thus serve the needs of the general society by providing technological knowledge and methods for solving several current problems of interest. There is no Masters programme in theoretical physics.

There is a Coordinating Committee (*Συντονιστική Επιτροπή*) to review the Master and Doctoral programmes. A significant number of the students graduating from the Department with the *Πτυχίον* enter the Masters programmes.

The Department has a well-established teaching evaluation procedure including a specialized questionnaire and a feedback mechanism to further improve teaching issues.

#### **APPLICATION AND RESULTS**

The Committee discussed the graduate programmes (Masters and PhD) with members of the faculty and with about 20 enrolled graduate students. There were many concerns expressed. The students emphasized the lack of scholarships, and expressed their concern about their future career prospects. Although they provide support to the Department's laboratories, they are unpaid and their work is not recognized.

It became evident that financial support for Masters and PhD students is totally absent and both faculty and students emphasized the need for a national scholarship system. Due to this absence of financial support, the students are obliged to take on outside work, effectively becoming part-time students and thus lengthening the duration of their studies. National scholarships for graduate students are a very common practice in major Universities around the world.

### ***IMPROVEMENT***

A major problem in the graduate programmes is the lack of national scholarships to support the students while attending the programmes offered by the Department. A structured national scholarship programme should be realized and offered over the long term.

The implementation of remunerated teaching and/or research assistantships would serve the dual purpose of providing financial support to graduate students during their studies and of providing expert scientific assistance for the presently under-staffed laboratories that in some cases lack the required technical support. Both the graduate students and responsible persons for the laboratories strongly support this proposal.

Another measure that will improve the situation would be to establish start-up funds for new faculty members in experimental physics. Such funds are available to new faculty at major universities in the US and Europe. The Department cannot hope to fulfill all its promise if it continues to be handicapped by the lack of start-up funds.

## ***A2.1 Teaching Undergraduate***

### ***APPROACH***

The teaching methodology adopted by the Department appears to be the same as that established internationally. It is based on a series of lectures, complemented by problem-solving sessions and exercises. In the case of physics laboratory courses, all students in a session perform on a rotational basis the required experiments; something that from a pedagogical point of view presents a disadvantage, although from the financial point of view it minimizes the cost of acquiring the necessary infrastructure (requires multiple experiment stations).

The educational material of the courses is posted on the Web pages of the Department and is suitably accessed by the students and faculty members via a security code.

All courses offered by the Department and the University are well supported in general, as far as the bibliography is concerned, by suitable conventional educational material (books and scientific magazines) as well as electronic material provided through the participation of the University in the Hellenic Academic Libraries (HEALink) network.

Most of the textbooks existing in the international bibliography, and in their translated versions, are used in the courses offered by the Department and can be found also in the Library, but not in multiple copies, whereas many theoretical and laboratory course textbooks have been produced by the members of the faculty.

The teaching staff-to-student ratio is approximately 1:25, given that there is 86 staff for the 2500 enrolled students. However, the teaching staff-to-active student ratio is much larger and it is about 1:10, which is close to international standards, since not all enrolled students are active. With respect to the guidance of students by the faculty members, each student has in principle an advisor during his/her studies, although this important feature is not used much by the students.

The equipment utilized in the undergraduate laboratory courses needs to be updated. Every effort should be made so that sufficient funds are secured for the corresponding maintenance of this equipment. For the more advanced equipment some further upgrade will help introduce additional features for new experimental exercises. Considering the large number of student sessions in the laboratories, more technical assistance is needed, either by hiring a few more technicians, or, more importantly, by providing a sufficient number of teaching assistantships to students doing their graduate studies. Currently, it is the graduate students and administrative/research/teaching/technical support and service personnel (ΙΔΑΧ, ΕΤΕΠ, ΕΕΔΙΠ ΙΙ) that support the teaching laboratories despite the large number of laboratories operating in the Department.

With respect to the student evaluation, the Department should make every effort so that a combination of continuous assessment of progress, including mid-term examinations, problem solving questions, oral and written examinations and practical exercises (in laboratory courses) is reinforced through-out a course.

### **IMPLEMENTATION**

The academic staff of the Department is currently composed of 86 faculty members; i.e., 27 Professors, 27 Associate Professors, 27 Assistant Professors and 5 Lecturers. There is also a number of academic staff being hired and a number of “*emeriti*” professors. The Department has 12 technical staff (ΕΤΕΠ), 9 technical/teaching staff (ΕΕΔΠ ΙΙ), 4 secretaries located in the various departmental sections, as well as 5 secretaries located in the Department Secretariat. In addition, there is 20 administrative/teaching staff (ΙΔΑΧ).

With the exception of the number of technicians, which is limited and apparently inadequate to serve the needs, the Department staff is sufficient to realize its educational programme, both at the undergraduate and graduate levels. Despite the fact that each laboratory course has to be subdivided into several groups (of about 12 students each) to cover the large number of the students attending, the overall performance, infrastructure, room-space availability and accompanying teaching material are in good standing.

The textbooks and additional notes provided for each course as well as the laboratory notes represent good introductory material to successfully overcome the difficulties of the required subject topics. In addition, the easy access to the physics and central Library, also remotely accessible via Internet connection, allows the students to utilize the international bibliography and progress in recent scientific developments. The existence of a separate physics library provides a greater flexibility of access to the bibliography and better support to the physics academic staff and student community.

A positive aspect of the undergraduate programme that should be underlined is the possibility offered for the students to participate in the European exchange programme Erasmus, allowing them to gain experience within the European Area of Higher Education. However, of the approximate 65 available positions per year only about 5 students per year take up such a position. This may be due to the added costs of entering such a programme as well as problems of mutual recognition of credits between the European Universities and the Aristotle University of Thessaloniki.

The Department has introduced the electronic collection of data for the evaluation of the teaching personnel, which enables the academic staff to draw useful conclusions about their overall performance and to improve the course syllabus and the feasibility of the physics programme to achieve its goals.

### **RESULTS**

Overall, the teaching performance and methodology as practiced by the Department need to be improved.

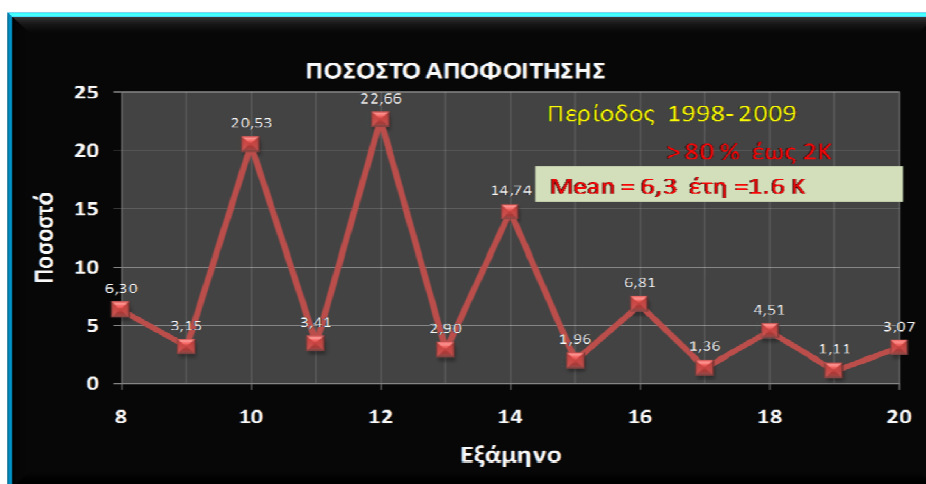
The intake of the Department is approximately 220 students per year until now. It is expected that following the request from the Department, this number will be reduced in future years. According to the statistics provided by the Department, the total number of undergraduate students currently enrolled is about 3500, but only 800 (~23%) of them study

in the first 8 semesters (normal degree period). About 1700 (~48.6%) are in higher semesters, and a significant number of about 1000 (~28.6%) are totally inactive students («αιώνιοι φοιτητές»).

The number of students graduating per year is on average about 120, which corresponds to about 55% of the entering students every year, but only to about 3.5% of all the enrolled students and to about 4.8% of the currently-active student body.

There is an uneconomical and unnecessary extension of the studies, which lies distinctly above the 4 years. For instance, according to the Department's graph shown below, the average duration of undergraduate studies is 6.3 years, and only a small fraction (6.3%) of the enrolled students succeed to graduate within 4 years. It is remarkable that after 9 and 10 years of enrolment there is still a number of students (3-5%) who also receive the degree (Πτυχίον). The average graduation grade is 7.1 out of 10, which is quite good under these circumstances.

In the last years, the situation of unacceptably long times for graduation (average over 6 years) has worsened due to frequent student occupations of the campus (Καταλήψεις).



Also, a rather high proportion (about 40%) of the graduating students continue with graduate studies at the Aristotle University of Thessaloniki or elsewhere.

### **IMPROVEMENTS**

The faculty members are giving appropriate weight to the promotion of physics to the local society and in particular to the younger generation. One excellent measure they use is to regularly receive groups of secondary school students and demonstrate to them various physics experiments. These didactic experiments should continue to be offered (in addition to the students of the Department), on a regular basis, to the secondary school physics teachers so as to promote the correct pedagogical methodology of physics teaching.

The Committee encourages the Department members and the University at large to take more actions towards advertising the Department's educational programmes more strongly to the secondary school student communities across Greece for their very good quality and specialization features.

The Committee also believes that the number of students enrolled in the Department has to be drastically reduced by about 50% in order to maintain the good quality of the programme. Like all other universities in Greece, every effort should be made to complement the existing national entrance examination system with the proper measures to attract only students wanting to study the particular fields.

## **A2.2 Teaching Master and Doctoral studies**

### **APPROACH**

The Department of Physics offers organized and structured graduate studies within a wide-ranging field of mostly applied physics domains. The graduate programmes consist of lectures and a research thesis leading to the award of a Masters and PhD degree.

The selection of students follows agreed procedures that include written examinations, an interview, and the consideration of the candidate's *curriculum vitae* and letters of recommendation. Acceptance of the candidate students is done after approval of the General Assembly of the Department.

Following the completion of the lecture series, the students select the research supervisor and are integrated within a research group. The topic of the PhD thesis is submitted to the Coordinating Committee of Graduate Studies (ΣΕΜΣ). The student can be integrated in the research earlier, should he/she wish. The Doctoral programme consists of a thesis based on a research project.

Graduate students enjoy similar arrangements as undergraduate students concerning accommodation, meals and medical care.

All costs for research carried out by graduate students are borne by the Department and the laboratory infrastructure is made available to the research students.

### **IMPLEMENTATION**

For each Masters course there are examinations, which are written and/or oral, as is described in the bulletin for graduate studies. The bulletin describes rules to be followed and the content of the course. Most of the material is available on the Internet. The courses also include problem sets and term papers. They are finally crowned by the Masters thesis, the latter of which may contain original work. This system presents the advantage of a closer collaboration between the student and the supervising professor.

For the doctoral programme there is a committee consisting of 3 faculty members who follow closely the progress of the candidate and the selection of the topic for the thesis. After the completion of the work for the doctoral thesis, the students present their research in an open seminar, in front of a seven-member committee, which subsequently examines them orally on the methodology and outcome of the research. Even if not a formal requirement, doctoral theses should lead to a publication in an international refereed journal.

### **RESULTS**

The students who complete the graduate programmes within the normal study period (of less than 5 years) are well-trained and with the potential for further evolution in academic and/or technology careers. The graduates achieved permanent positions at universities, research centres and the private sector in Greece and abroad. The Department graduated 64 PhDs and 293 MSc. during the period 2004-2009.

***IMPROVEMENT***

As presented above, it is necessary to secure scholarships for all graduate students, at Masters and PhD level. This can be realized through the implementation of teaching and/or research scholarships and through the submission of applications for the HERAKLEITOS and THALES programmes.

The Committee considers that the University must introduce a Didactic of Physics Master graduate programme for teaching in Greek secondary schools and the Greek authorities should then recognize the awarded certificate.

The Committee recommends that the graduate experimental laboratories require the additional support of technical personnel.



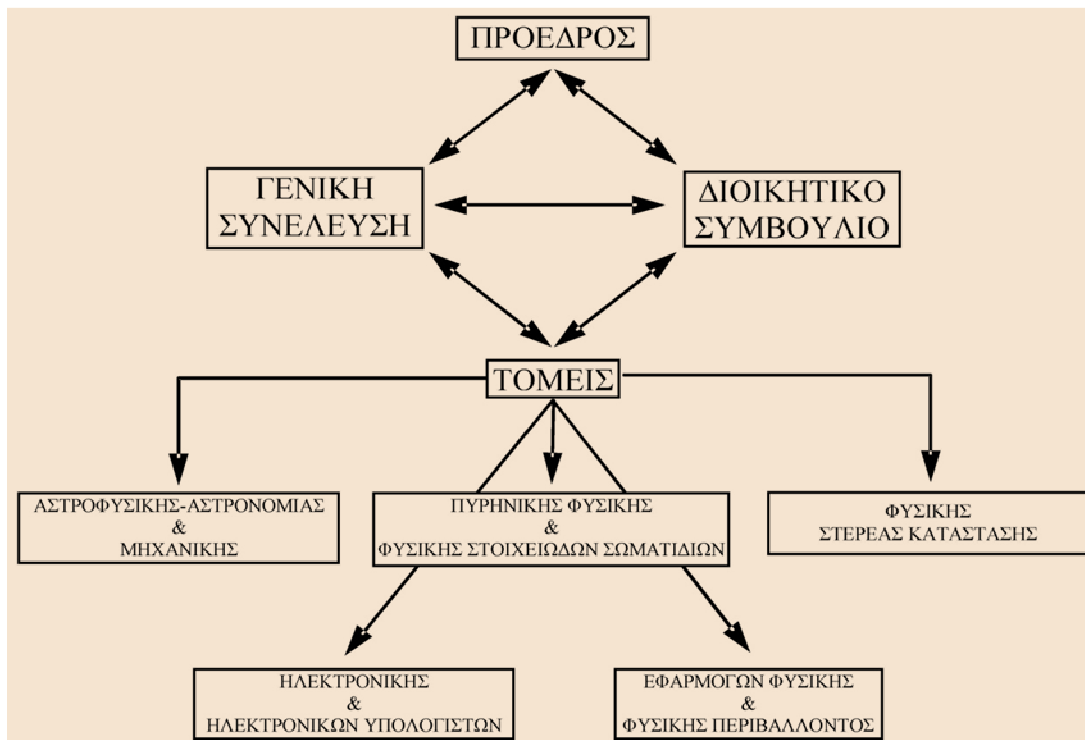
## B. Research

### APPROACH

The Department strives for excellence in research, by concentrating in a few selected and state of the art themes within 5 general Sections:

1. Astrophysics, Astronomy and Mechanics (12 staff members).
2. Nuclear and Particle Physics (20 staff members).
3. Solid State Physics (34 staff members).
4. Electronics and Computer Systems (4 staff members).
5. Applied and Environmental Physics (17 staff members).

The administration structure of these research sections is shown below:



The Department promotes research by appointing Greek scientists, many of whom are graduates of the Aristotle University of Thessaloniki with experience from working at outside international institutions of high calibre.

The research level is high, as indicated by the large number of publications in internationally recognized peer-reviewed journals (about 2.7 publications/staff member/year, for the time period 2003-2009). This is also reflected in the ability of the Department to attract competitive grants from European research programmes.

The distribution of resources (personnel, funding and equipment) across the 5 Sections is uneven with a high concentration of resources in the Solid State Section.

In the past five years the Department has been very successful in securing research funds from competitive external grants. The following graph shows that the vast majority of their budget comes from competitive grants, out of which 2/3 are international.



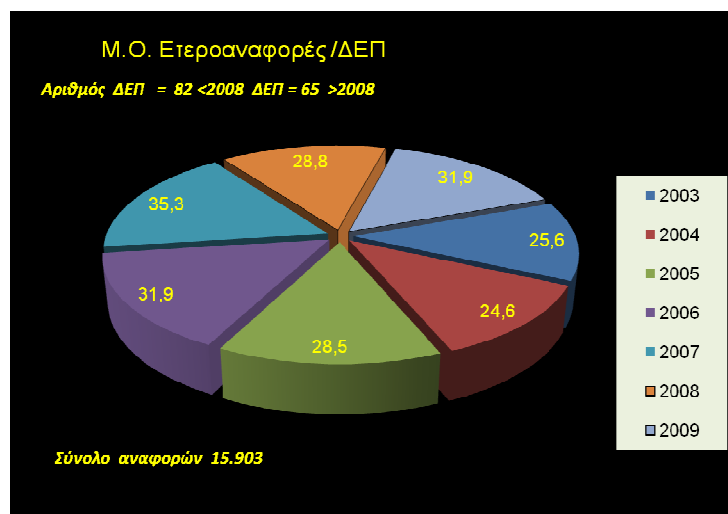
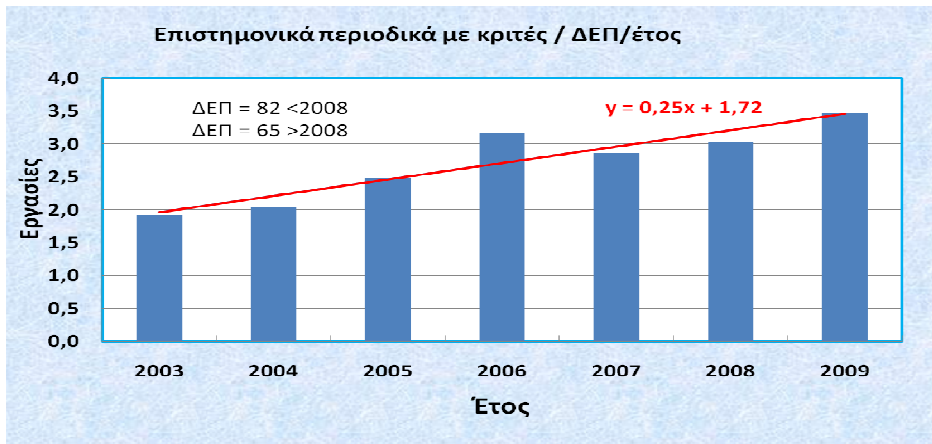
The research is supported by 293 Masters students and 64 doctoral students who are actively involved in the research. The number of postdoctoral fellows is minimal and depends on the success of grants from the European Commission. The number of graduate students is excellent despite the lack of national financial support. On the other hand, the low number of postdoctoral fellows is a deep concern.

The Committee considers that the number of technical personnel in the laboratories is clearly inadequate and must be addressed. This could be done either by the appointment of the necessary technical personnel or with the implementation of the teaching and/or research assistantships of graduate students.

### ***IMPLEMENTATION***

From the Department's official data made available to the Committee, the following numbers are obtained:

1. The members of the Department published 1446 articles in refereed journals in the period 2003-2009, corresponding to an average value of about 2.7 articles per year and per faculty member. For the last three years (2007-2009), the corresponding numbers are 657 articles in refereed journals and 3.1 articles per year and per faculty member (see Department's own graph below). These numbers are considered to be very good.
2. The total number of citations is more than 15 903 for the period 2003-2009. For the last 3 years, this corresponds to about 32 citations per member and per year (see Department's own graph below).
3. These figures are considered to be good in relation to other physics departments in Greece.



There are significant research collaborations of members of the Department with research scientists of universities and research institutes in Greece and abroad.

## **RESULTS**

The Committee did not receive a clear statement on the Department appointment policy, in order to assess the distribution of staff appointments between Sections and academic levels. The Committee observed a disturbing distortion in the distribution of staff members in age, academic level and between Sections. The Committee thus considers that this will create serious problems in the research programme of the Department, in particular in view of the significant departure of several staff members (see figure below).

The Committee strongly recommends an increase in the appointment of scientists from outside of the Aristotle University of Thessaloniki.

The result is therefore a highly visible research in a few selected areas, like solid-state physics and environmental physics, which have succeeded to obtain international recognition. The nuclear and particle physics group is also highly visible with considerable contributions to forefront high-energy physics experiments, in spite of the small size of the group.

The Committee noted an excellent performance of the Solid State and of the Applied and Environmental Physics Sections, in scientific production, international collaborations and active participation in European research programmes. In these domains the scientific activities of this group meet those of well-known institutions at the international level.

### **IMPROVEMENT**

- The Committee identified as the most serious concern the uneven distribution of resources across the Sections (academic staff, budgets and infrastructure) and in particular the preponderance of resources being concentrated in the Solid State Section.
- In view of the above concern and the imminent departure of a significant number of staff members in the next 5 years and with the opening and the subsequent arrival of new appointments, the Department should take the opportunity with the new appointments to drastically re-organize its experimental Sections according to a well-established plan reflecting the future structure and profile of the Department.
- The Committee considers that the Solid State Section has a high-calibre scientific expertise, knowledge and instrumentation/equipment in material science and technology. The Committee suggests that the core of this Section should be attached to an institute, such as the Hellenic Centre for Research and Technological Development (EKETA) or Technological Institute (ITE) or a separate university research unit. This resulting entity should be inter-disciplinary in nature (physics, biology/medicine, chemistry, etc.) in order to provide links to local high-technology industry. The Committee also finds that the Solid State Physics Section should be strengthened in the direction of theory, including theoretical condensed matter and statistical physics.
- The Committee finds that the Electronic and Computer Systems Section has a very good research programme. However, it is under-resourced and requires further strengthening, by, for example, becoming attached to the Nuclear and Particle Physics Section. This would allow the group to link up with international projects.
- The Committee finds that the Applied and Environmental Physics Section is successful. However, in view of the fact that the research topics recently covered (magnetic materials and material science, X-ray applications, radio- and tele-communications, atmospheric and environmental physics) is very broad, not focussed and without thematic-internal synergy, the Committee believes that this Section should be better organized in the future. For instance, some of the above-mentioned research items can move to already-existing related topics (i.e., in Solid State Section and Electronic and Computer Systems Section), leaving a core section focussed on *Atomic, Molecular and Environmental Physics*.
- The Committee finds that the Nuclear and Particle Physics Section has a very good research programme and is successful in its participation in nuclear and particle physics experiments. However, the Committee considers that the Section is under-resourced and believes that it should be strengthened in the future (in both experiment and theory).

- The Committee considers that the Astrophysics, Astronomy and Mechanics Section has a very good research programme and has been successful in carrying out a varied programme of both observational and computational research. However, the Committee considers that the Section is under-resourced and believes that it should be strengthened in the future and the work on mechanics should be further directed towards celestial mechanics. The Committee also recommends that this Section should be further extended to cover or strengthen fields such as astroparticle physics and cosmology.
- The Committee finds that the longer-term recruitment policy is lacking for the Department. This policy should be drawn-up and agreed in the Department and should reflect the future needs of the Department. For example, the appointment of new academic staff should ensure that the high number of retirements in the near future is covered. The new appointments should also meet the requirements of the future teaching programmes and number of students. They should also reflect the new Section structure of the Department.
- The research laboratories must be refurbished and brought up to modern standards in equipment and safety. The allocated space for the laboratories is adequate but its presentation must be improved to create an attractive research environment. The Committee considers that the research infrastructure is very well organized and preserved in very good condition but located in inadequate space. The Committee underlines that measures should be taken for the continuous refurbishing and maintenance of the research laboratories in order to preserve their present reasonable state, while expanding further to provide more possibilities and improving the experimental set-ups. However, there is an absence of specialized technicians to discharge the scientists from technical work. The present situation, with only primarily unpaid graduate students covering the needs of so many research groups, is not satisfactory.
- The Department does not have its own mechanical and electronics workshops, resulting in the groups simply purchasing equipment from outside firms without becoming involved in the upgrade of instrumentation and equipment and the transfer of technology.

## ***C. All Other Services***

### ***APPROACH***

- The administrative services seem quite effective, adequate and recently modernized (student Web subscription, grading by professors on the Web and the recent introduction of the management of electronic book distribution). The personnel seemed content with the arrangements.
- The technical support (36 persons) for teaching and supervising at the laboratories is evidently sufficient to cover the needs of the curriculum. The existing personnel are currently filling the gaps with a lot of self-sacrifice and extra non-remunerated hours, but this is not something that can last for the long term.
- Secretarial support is provided by a central Departmental Secretariat (5 Secretaries) from the pool of administrative/teaching (ΙΔΑΧ) and by 4 Secretariats serving the 5 Sections. The Secretariat of the Department is open daily from 08:00-14:00. The services offered by the Secretariat are considered to be adequate. Amongst its responsibilities, the Secretariat handles student registrations, examinations and the distribution of the education material. However, most of this secretarial staff do not have the proper studies (secretarial studies, accounting) and certificates (foreign language, computer certificates) and did not go through the necessary training.
- The Department is served by the well-organized physics library, which includes modern electronic facilities. The library is run by a well-trained and professional librarian and also by 10 students on a volunteer basis.
- The Department is also served by the well-organized information technology service. The service is run by two well-trained and professional computer scientists, and who are assisted by 10 students on a volunteer basis.

### ***IMPLEMENTATION***

- The administrative infrastructure is adequately organized in the Department. Information exchange with students is partially ensured via electronic means.
- The Physics Library is very pleasant, spacious and sufficiently modern. The Department has WiFi Internet access throughout. Information exchange with the students is done electronically. Students can access the library information remotely.

### ***RESULTS***

The members of the administration, who are mostly scientists (IΔAX), are not professionally trained in secretarial functions, which may result in inefficiencies.

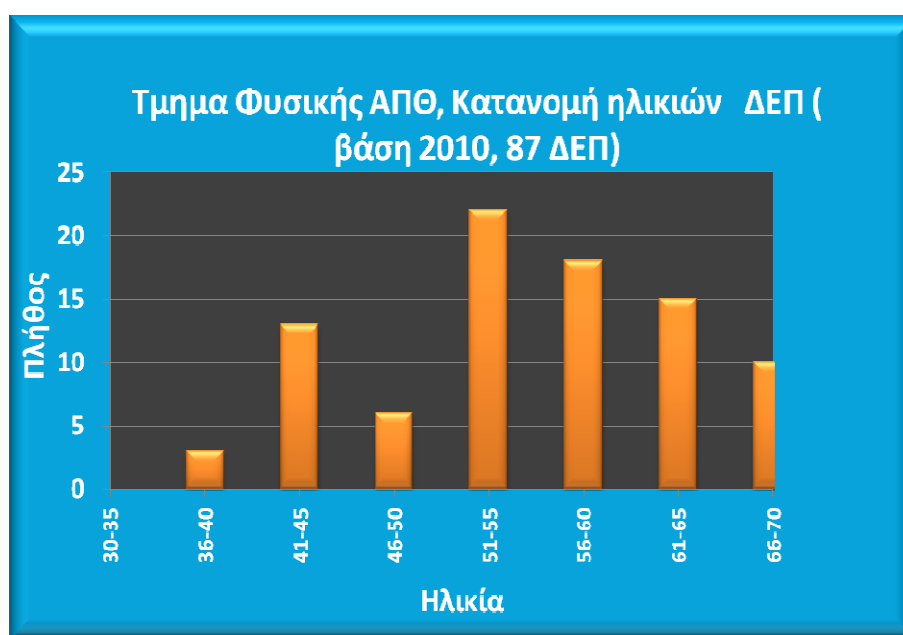
There is a pronounced inadequacy of the number of the technical personnel in the Department.

### ***IMPROVEMENTS***

- A clear priority of the Department is the recruitment of new technical personnel.
- The advertisements of the secretarial staff positions should contain, according to the duties of these positions, the necessary minimum qualification degrees (secretarial studies, accounting) and required certificates (foreign language, computer knowledge). Also, all secretarial personnel should undergo thorough professional training on a regular basis.
- A physics exhibition laboratory should be created with the aim of engaging the general public and schools from the surrounding areas to physics ideas.
- The Department should acquire external funding from specialized National and/or International sources in order to develop further a plan for the formal establishment and constant upgrade and maintenance of the High Performance Computing Cluster, which should develop into a Centre (Tier2) with large processing power and storage capabilities and high level instrumentation, within the framework of the HELLAS-GRID. Such a Tier2 centre is absolutely necessary and will be of invaluable help for most of the research projects performed in the Department with intensive calculation or large database needs.

### ***D. Strategic planning, perspectives for improvement and potential inhibiting factors***

- Short, medium and long-term goals.
1. The curriculum is not well organized structurally. The Committee considers that the number of elective undergraduate courses (114) is very high and all efforts should be made to drastically reduce their number to about 40 by combining similar thematic topics.
  2. The Administration staff has the electronic tools to adequately handle the services offered in support of the students and the staff. This includes the services for student registration, recording of examination marks and the general student records. However, the staff needs to have the proper qualification degrees (for example secretarial studies, foreign language certificates etc.) and to go through continuous training. The electronic systems should also be linked to the rest of the University.
  3. The absence of technical personnel is clearly inadequate to cover the needs of the Department and especially those of the laboratories taking into account the large number of students attending the laboratory sessions. It must be organized in a better way in the future with, for example, the introduction of a teaching and/or research assistantship programme for graduate students and with the hiring of specialized technical personnel.
  4. Considerable efforts of science communication and outreach with local schools are well established through the various programmes (high school teacher programmes and Master classes). A careful planning of the outreach and a better link with the local schools and the wider community of the region has to become more prominent in the aims of the Department.
  5. The age distribution below shows that a large number of the academic staff of the Department will reach the age of retirement within the next 5 years. The Department will be coming in the next 5 years to a crossroad and this is an opportunity for the Department to plan its future in detail and very seriously.





- It is important that the Department maintains its continuous efforts to produce world-class research. This would require the gradual renewal of the research staff and the research laboratories, resulting in the introduction of state-of-the-art research infrastructure and facilities.
- The Committee's proposed restructuring of the research groups detailed in Section B would improve the coherence and focus of research in the Department and the interactions with other international centres of research.
- Synergies and links with the Medical School of the University need to be strengthened in the areas of radiation physics and medical physics.
- Studies in physics didactic should be introduced and should be automatically recognized by the National authorities to meet the criteria for secondary education teaching certificate equivalent in the country.
- Like in most other universities in Greece there continues to be a relatively high percentage of students admitted to the Department through the national examination system without the students necessarily wanting to become physicists. This problem holds for almost all scientific fields and has to be seriously addressed by the State, in close collaboration with the universities.
- A system of fellowships and teaching and/or research assistantships should be introduced for the graduate students, so that more of them become involved in research, assisting the established scientific groups in their teaching (problem solving sessions, experimental exercises) and in their pursuit for quality research.

Finally, two comments of general nature that seem to hold for all Greek universities:

1. The universities are restrained by the Law, which does not permit them to distribute some allocated funds and positions according to their needs. They do not have sufficient self-governance to redirect funds and positions according to their strategic planning. Each university should be given a budget and be allowed to set its priorities.
2. More effort should be made by the relevant State authorities to ensure the continuity and non-interruption of the functioning of the University throughout the academic year. This seems to be a general problem in Greece.

## ***E. Conclusions:***

Conclusions of the External Evaluation Committee and recommendations:

Most of the research in the Department is of high calibre and meets international standards.

- In its long history, most of its members have remained active.
- Many of its graduates have pursued careers and obtained positions in several established universities and institutes world-wide, and many of them stayed at the Aristotle University of Thessaloniki to take up staff positions.
- The Committee noted the absence of other research institutes in the area and also the lack of collaboration between the physics research groups and other groups of the University, for example the Medical School.
- The deficiencies in undergraduate and graduate studies are attributed more to the general institutional structure of the Greek universities and the peculiarities of the admission system.

The Committee strongly believes in the necessity to implement an efficient system of scholarships for all graduate students, at the Masters and at the PhD level. This can be realized through the implementation of teaching and/or research scholarships and through the submission of applications for European and/or National research funding.

The Committee recommends that the graduate experimental laboratories require the additional support of technical personnel. Graduate students with an appropriate teaching and/or research assistantships would successfully support the undergraduate laboratories and help in the realization of the teaching undergraduate programmes.

The Department should follow a plan for the recruitment of new, young faculty members. The plan should guarantee the continuity of a well functioning educational programme, taking into account the retirement of a large number of faculty members and the dynamic scientific developments of our times.

The Committee believes that the Department should organize an efficient recruitment policy reinforcing its scientific and technical personnel along the lines of the proposed recruitment policy by the Committee.

The number of undergraduate students entering first year in the Department is about 220, while the current total number of “active” students is about 2500. The Committee experienced that the great majority of them and particularly those “under degree” do not attend the courses offered by the Department and they cannot be considered as active students (since they simply attend only the examination periods). The Committee believes that the number of students entering in the Department has to be drastically reduced by more than 50%, to about 100 students per year, in order to achieve a much better educational functionality, and a more efficient student care in accommodation and restaurant facilities.

Moreover, students should be continuously evaluated for each course and should be enrolled in only a certain number of courses at the beginning of each semester. They can then participate in the final examination, provided they have fulfilled certain pre-specified course evaluation criteria. Failure in one course should require repeating the course evaluation procedure from the beginning.

The scientific work of the Department is severely obstructed by several factors that occur in general in all Greek universities:

- The lack of the timely renewal of academic staff and the delay in completing the appointment process.
- The heavy administrative burden and bureaucracy involved in the Department processes, such as recruitment and budget allocation.
- Financing of participation in conferences/workshops/schools outside of Greece and within Greece is practically non-existent.
- Start-up funds and matching funds for new academic staff are non-existent.
- Delay in the approval and roll-out of the research programmes supporting both students and academic staff.
- There is no structural position of postdoctoral fellowships.

#### **IMPORTANT NOTICE:**

The Committee is seriously concerned by the student occupations (**Καταλήψεις**) in the last years, with the high frequency of occurrence and with the resulting destructive fall-out and repercussions in the study and research activity of the Department. In particular, the Committee observed that this phenomenon has increased in the last years with the result that the length of study is lengthened and the conferment of degrees is delayed. This situation is also unacceptable as it also hinders the academic staff to carry out their research and to access their offices and laboratories.

The Committee's work during this evaluation was also hindered by an occupation caused by a minority of students, forcing the Committee to leave the reserved venue of the evaluation process in the Department and move to the central university buildings.

From the present situation in all Greek Universities it is clear for the Committee that a new, with long-term perspective and power, University Law set by the Greek State is highly required. This would contain important ingredients towards university excellence in education, research and professional orientation. To this end, a drastic re-organization and re-consideration of the number of entering students - and the way that they are enrolled in the various university departments - as well as the size and structure of the universities should be considered very seriously. According to international experience, most of the well-established universities self determine the number of the incoming students as well as the way (entrance criteria and/or examinations) that they are enrolled in the university departments. The Committee would like to emphasize that this international practise must be adopted also by the Greek Universities.

In a modern university aiming at excellence, a flexible, active and experienced governing body is required. As a first step towards this achievement, the Committee considers that the Rector and Vice-Rectors should be elected only from the body of the academic permanent staff members and only for a one-term period.

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ARISTOTLE UNIVERSITY OF THESSALONIKI  
DEPARTMENT OF PHYSICS

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