



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus universiteto
TEORINĖS FIZIKOS IR ASTROFIZIKOS PROGRAMOS
(621F30004)
VERTINIMO IŠVADOS

EVALUATION REPORT OF
THEORETICAL PHYSICS AND ASTROPHYSICS
STUDY PROGRAMME (621F30004)
at Vilnius University

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Išvados parengtos anglų kalba
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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Teorinė fizika ir astrofizika</i>
Valstybinis kodas	621F30004
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Fizika
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Antroji
Studijų forma (trukmė metais)	Nuolatinė (2)
Studijų programos apimtis kreditais	120
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Fizikos magistras
Studijų programos įregistravimo data	1999.09.14

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme:	<i>Theoretical Physics and Astrophysics</i>
State code	621F30004
Study area	Physical sciences
Study field	Physics
Kind of the study programme	University studies
Study cycle	Second cycle
Study mode (length in years)	Full-time (2)
Volume of the study programme in credits	120 credits
Degree and (or) professional qualifications awarded	Master of Physics
Date of registration of the study programme	14.09.1999.

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The Centre for Quality Assessment in Higher Education

CONTENTS

CONTENTS	3
I. INTRODUCTION.....	4
II. PROGRAMME ANALYSIS	4
1. Programme aims and learning outcomes.....	4
2. Curriculum design	5
3. Staff	7
4. Facilities and learning resources	7
5. Study process and student assessment.....	9
6. Programme management	10
III. RECOMMENDATIONS	11
IV. SUMMARY	12
V. GENERAL ASSESSMENT	13

I. INTRODUCTION

The Evaluation Report was prepared about the Study Programme of *Theoretical Physics and Astrophysics* at Vilnius University (hereinafter – VU). This second cycle programme is in the Study area of Physical Sciences, its study field is Physics and gives out a qualification degree of Master of Physics. The programme was registered on 14.09.1999. The members of the Expert Team, which is responsible for the Evaluation Report, were selected and appointed by the Centre for Quality Assessment in Higher Education of Lithuania. The personal composition of the Team can be seen on the introductory page of the Evaluation Report.

The study programme is one of the nine second cycle programmes in Physics at the Faculty of Physics at Vilnius University. This programme is an important member of the second cycle programme family, because its topics deal beside the elevated knowledge in Physics with one of the major part of the physical sciences, with the theoretical approach of the phenomena. The programme has grown out from the theoretical studies, but it has been developed in the last two decades besides focusing on theoretical physics, on the field astrophysics, as well. This development was justified by the fact that both sections of Physics use similar methods in computation. From that point of view, the scope of the programme seems to be the result of a logical development.

The Evaluation Report has been prepared on the basis of the study of the Self Assessment Report and with the help of a series of group discussions with different teams of affected people on the 9th of October, 2013. There was a discussion (already on the 8th of October) with the administration staff, on which every responsible partners were present from the side of the Faculty of Physics. A meeting was organized with the staff responsible for preparation of Self Assessment Report (two members of the staff were there). Then the Expert Team had a meeting with the teaching staff (8 people, about half of the teachers were present) and with the students (8 students, about half of all the students of the programme were there). The Expert Team - already on the 8th of October - visited the auditoriums, libraries of the departments, teaching places used in the educational process and have been shown the supercomputer, which is available for the master degree students of *Theoretical Physics and Astrophysics*. The experts had possibility to familiarize with the thesis and examination materials of the graduates of the programme. It was followed by meeting with alumni (3 persons came) and with a discussion with social partners, represented by 5 persons in managerial position. The site visit was concluded by a discussion with the partners responsible for the master degree study programme *Theoretical Physics and Astrophysics*.

All these steps of the evaluation process were run without any disturbing effects, fully according to the rules of the Centre for Quality Assessment in Higher Education of Lithuania. The Expert Team evaluated all the gathered information in closed section. The Evaluation Report of *Theoretical Physics and Astrophysics* was accepted by all members of the Expert Team with a one vote will.

II. PROGRAMME ANALYSIS

1. Programme aims and learning outcomes

First of all, the Expert Team acknowledges the uniqueness of this study programme in the panorama of higher education in Lithuania. Following historical tradition in the field, Faculty of Physics provides an exceptional opportunity that no other university can offer. It is also clear that the programme is very much demanding, corresponds to the international standards, prepares well for doctoral studies and it is suited only for the most talented.

Secondly, the Experts Team notes that the aims and learning outcomes of the study programme are clear, self-consistent and comply with legal, scientific and pedagogical requirements, they are also publically accessible. In brief, the study programme intends to provide:

- A. Ability to carry out research in the field of astrophysics, quantum theory of micro objects; having acquired sufficient theoretical knowledge and practical skills, pursue doctoral studies and a doctor's degree in physical sciences;
- B. Training of highly qualified specialists in Theoretical Physics and Astrophysics in compliance with international standards, who have profound knowledge of physical processes and computer modeling, able to choose appropriate modeling techniques and plan their research work;
- C. Training specialists with theoretical knowledge and practical skills, able to develop and apply theoretical modeling and forecasting methods in manufacturing, economics and expert activity;
- D. The knowledge of the scientific and technological achievements important for the education of the society.

Even though, most of these aims have pertinent learning outcomes and consistent individual courses that contribute to these outcomes, the aim C needs some special attention and clarification. For example, it is not clear how theoretical knowledge and practical skills can be applied in “manufacturing, economics and expert activity”. Students would need to take additional courses to be able to use theoretical methods, modeling and computational skills in specific fields of applications – otherwise they will not be well placed for potential and immediate jobs in these applied areas. On the other hand, through the discussions with the involved staff and by review of MSc thesis, the Expert Team could be provided with some concrete examples how this issue is tackled in practice. Nevertheless, the Expert Team recommends that even during the lectures and practical courses the theory and models should be illustrated by representative examples in the applications mentioned in the aim C, namely “manufacturing, economics and expert activity”. This is needed not only for the coherence between the aims and the courses offered but also for illustration how theory is applied in diverse fields of society related issues. Last but not the least, these concrete examples will serve as a bridge between theory, models and computational methods newly introduced in the study programme through the modules in computational physics and use of high-performance supercomputers. Certainly, practical applications of complex theory and modern computational methods would be an additional stimulus to attract more students to this study programme. This would also open, in addition to PhD studies, other job opportunities to programme graduates.

2. Curriculum design

The second cycle study programme *Theoretical Physics and Astrophysics* bases on “Description of General Requirements for Master Studies” approved by the decree No. V-826 of June 3, 2010 of the Minister of Science and Education of the Republic of Lithuania and the decree No. V-231 of February 8, 2012 of the Minister of Science and Education of the Republic of Lithuania “On Replacement of Approval of Description of General Requirements for Master Studies”. With this, Expert Team confirms the fulfillment of the legal requirements of the study programme.

Curriculum design subjects and modules are well designed and divided rationally among the semesters. There are compulsory course units of the programme that are essential for all students, i.e. serve as the basis for their future doctoral studies as well as those courses, which are important both for the students of Theoretical Physics and for future astrophysicists. These are Quantum Statistical Mechanics, Physical Kinetics, Data Analysis Methods, Astrobiology and

Synergetics of Life. Expert Team would like suggest study programme leaders to analyse the “Astrobiology” and “Synergetics of Life” courses position in the compulsory course list as far as content of these course suits better for elective courses list. There are several courses in elective courses list, e.g. “Methods of atoms theory” and “Modern theoretical physics” that could fit perhaps better to the essential list of mandatory courses.

The overall list of courses is relevant to the study programme and there are no repetitive courses. The levels of the courses correspond to the study programme level. Programme committee has made several modifications from last accreditation in 2005. Thirteen course units were eliminated from the present study programme. The eliminated courses were too specific ones and not gained too much attention. Expert Team confirms this is a right decision. Students with really specific research tasks should discuss those issues with supervisor and study individually. All those modifications made current study programme output wider and therefore avoiding highly specialized academic subjects. Most of the study programmes aims are covered with courses.

However, third aim (*training specialists with theoretical knowledge and practical skills, able to develop and apply theoretical modeling and forecasting methods in manufacturing, economics and expert activity*) last part that treats forecasting methods in practical fields is not covered by lectures. Also, the learning outcomes are not according to this aim. Still, Expert Team has met several master thesis treating above-mentioned topics. The scope of the programme covers most of the learning outcomes. However, the programme aims and learning outcomes should be clarified. Currently there are confusing statements like, “*The aims of Theoretical Physics and Astrophysics study programme that are introduced in detail in Table 2 are related to Study programmes*”. The connection between “related to..” and “programme real aims” is deceptive. Expert Team recommends leaving only real study program aims and removing “comments like aims”.

Another issue is connected with final thesis. In most cases the thesis composition was not clearly presented. Only in one in ten thesis abstracts started with clear aim formulation e.g. sentence “*The aim of current work is..*”. Others just described the activities and measurement results. Therefore, Expert Team recommends explaining more in detail to the students the final thesis composition style and format. As it is related to the final aim of the study programme (*acquire ability to communicate orally and in writing in the Lithuanian and English languages, to work individually and in teams, to organize their work and plan time, to study and constantly develop their professional and general knowledge*), there should be probably an additional mandatory course about composing scientific reports and thesis documents.

Another issue is with achieving professional knowledge in English. In communication with students, Expert Team agrees with their will to have more seminars presented by foreign scientists to engage more updated knowledge and therefore improve their scientific English. An outstanding example is the course “Cosmology”, where foreign lecturer presents content in English. Expert Team encourages study programme leaders to find more lectures from abroad.

One of the strongest aspects in this particular study programme is well-motivated lectures with strong scientific background. It is not typical that study programme lector is also active in teaching and same time successful in high-level science. Most of lectures have related scientific interests and therefore there is a direct link between course content and latest achievements in science. Students also presented their will to concentrate weekly based lectures in two days to have more consistent time in scientific labs. There are top level super-computer facilities available, what is already exploited in several tasks and there is clear engagement to include “the applications of modern high-performance computing systems”. This is one of the most pertinent ways to enlarge the number of interested students and motivate them for theoretical part of the programme.

3. Staff

The teaching staff is optimal for this study programme. Second-cycle students of *Theoretical Physics and Astrophysics* programme are taught by 19 members of the teaching staff from the faculty of Physics (16 doctors and 3 habilitated doctors), among them: 5 professors, 8 associated professors and 1 lecturer are working at Vilnius university full-time, 1 professor and 4 associated professors are employed part-time, which is in accordance with the general requirements for the study programmes. The average age of the teaching personnel is sustainable as it currently is 49. Expert Team acknowledges leaders' efforts about this relatively young age factor. It should be pointed out that this number is outstanding and it ensures the staff sustainability. All teachers are experts in their field and that ensures the teaching quality. There was visible mobility in staff during the last 5 years (12 teachers left the faculty, 3 new recruited, some additional former graduates do part-time teaching). The age of faculty members will further decrease due to the on-going mobility and planned fresh recruitment. Practical work experience of the teaching staff is approximately 23 years, teaching experience – 13 years. As already mentioned in chapter above the first engagement of a foreign lecturer at full time has been successfully performed. Also, students presented their will to have more lectures in English language.

The average contact workload of the teachers who work in *Theoretical Physics and Astrophysics* second cycle programme is 74 working hours, whereas the total contact workload at Vilnius University is 212 working hours. The programme had 15 students on the 1st of February, 2013, what correspondes to 0.8 students per one member of the teaching staff. Taking into consideration the fact that part of the teachers work part-time (0.25 or 0.50), the student-teacher ratio in the programme is 1.5 to 1. It should be emphasized that teaching on the second cycle programme *Theoretical Physics and Astrophysics* is only a small part of the teaching workload that the staff does. They also teach in other programmes of the faculty, supervise students' research work and their final theses, and check their written assignments. Besides teaching, the staff is also involved in research as well as in project work both from Lithuanian Research Council and international projects. Participation in scientific and methodological projects is directly related to their professional development. The content of the courses taught is constantly updated on the basis of project results achieved. It is especially important for the academic subjects related to the use of computer technologies because of numerous innovations emerging every year that our students need to be aware of.

The lecturers' mobility is of high level. Many teachers have "abroad-working" experience (14 members of the teaching staff in the recent period of 5 years). All scientists teaching on the programme present results of their research at scientific conferences in Lithuania and abroad. This ensures input to the certain lecture course and the exchange of latest scientific trends. Faculty administration is also active in recruitment of new teaching personnel. Among the PhD students who have defended their thesis in the faculty the best ones are invited to teach.

4. Facilities and learning resources

The premises for studies are adequate both in their size and quality. There are several classrooms in Faculty of Physics with enough places (one with 79 working places, 4 with 56 working places each, 5 with 40 working places each, 4 with 20 working places each, and 4 with 12 working places each) well equipped for demonstrations and with multimedia which can be used for lectures, seminars and workshops of this program students. Department of Theoretical Physics which coordinates this program has special classroom denoted Prof. A. Jucys (54 m², 48 working places) recently repaired. There is one specialized classroom in the Astronomical Observatory (31 m², 10 working places, this was not visited by the Expert Team, however it got information about it) and 1 computer classroom (31 m², 5 working places). The teaching laboratories are constantly renewed and equipped with new scientific devices by using EU

structural funds, National complex programme. During the implementation of these projects a number of teaching tools were issued, the laboratory equipment as well as computer hardware and software were renovated, 2 high performance computers (about 140 and about 1100 computing cores) were bought and new specialized software was acquired. For their research and final theses students of the programme have access to Molėtai Astronomical Observatory resources, including the following telescopes: 165 cm Ritchey-Chretien reflector; 63 cm Cassegrain reflector; 35/51 cm Maksutov telescope. CCD cameras for taking images of stellar fields or star spectrophotometers can be mounted on them. To ensure the study process the Department of Theoretical Physics and Astronomical Observatory spend about 25000 Lt yearly to acquire the most necessary equipment. Laboratory and computer equipment are adequate. Equipment for the studies is modern and constantly being updated.

Teaching materials are adequate and accessible. Department is gradually renovating teaching premises of the faculty, installing new equipment and various teaching programmes, adding new text books to library funds, introducing the contents of course units of most teachers online. In the period of 2007–2012 15 lecture notes, 16 lecture presentations and 36 descriptions of laboratory works were updated. Students can use reading room of VU Faculty of Physics now moved to National Open Access Scholarly Communication and Information Center close to the faculty, which is the largest and the most modern library and reading hall in Lithuania with 670 working places, open 24 hours.

Cooperation with businesses is established via students' research work performed in scientific laboratories and enterprises. An example could be a cooperation agreement signed between the Faculty of Physics and Lithuanian Hydrometeorology Service. According to the agreement, second cycle students of *Theoretical Physics and Astrophysics* are expected to join the projects of the Hydrometeorology center, master the latest forecast calculation program HARMONY and investigate possibilities of its use for modeling environmental challenges. While installing programmes and making use of the supercomputer capabilities, the students of the programme cooperate and have consultations with Bull Lietuva and UAB B.G.M. IT specialists. A part of *Theoretical Physics and Astrophysics* second cycle programme students have their research placements in scientific laboratories of the faculty, Vilnius University research institutes, in the laboratories and institutes of the Physical Sciences and Technology Center. In this case no difficulties arise, as there are agreements signed with these institutions. At the department of Theoretical Physics research placements are carried out in the fields of electronic structure of molecules, theoretical molecular spectroscopy, condensed matter physics, electromagnetic radiation. A smaller part of the students performs the research in companies, which frequently are going to be their employers in the future at their own or at the companies' initiative. One of the main obstacles to organize placement in companies is the shortcoming in the legal basis related to studies. Businesses are not encouraged to offer placements for students, moreover, they are burdened with cumbersome bureaucracy, as a result of which very few companies are willing to get involved in the scheme. However, the efforts to improve the situation should continue.

VU Library subscribes over 50 global databases which make it possible for the University library users to read different scientific magazine articles. VU library is modern, computerized with free internet palaces and free WiFi connections and easily accessible for students. VU library subscribes a number of databases related to the subject-matter of laser physics and optical technology study programme. Study literature is added to the library funds every year. New books are purchased in VU library according to teachers' recommendations. The students can also connect to the subscribed databases from their homes by using the University supplied VPN (Virtual Private Network) service. The Expert Team recommends to maintain the investments further into the most demanding textbooks in the near future.

5. Study process and student assessment

Candidates who graduate in the first cycle physical, technological and biomedical university studies and possess a Bachelor's qualification degree of these areas can be admitted to the second cycle *Theoretical Physics and Astrophysics* study programme. Those who graduate in other study fields need to take required fundamental courses of the study programme and to present a thesis on the topic of physical or technological research areas. Applicants are rated according to their competition scores. So, the admission requirements are well-founded.

The organization of the study process ensures an adequate provision of the programme and the achievement of the learning outcomes. The ratios of time in the first three semesters are about: for lectures 20 %, workshops 20 % and autonomous work 60%. Fourth semester is all for thesis preparation by autonomous work. The 4th semester is entirely devoted to research work (working on the final master thesis).

Students are also encouraged to participate in research activities. Participation in the scientific seminars at the department of Theoretical Physics and Astronomical observatory is mandatory for the second cycle students. They are also invited to the seminars organized by Physical Sciences and Technology Center Molecular dynamics laboratory. During the seminars the students give presentations on their research topics, which are a good school of scientific work. Master final project is carried out in the departments of the Faculty of Physics, research institutes and various manufacturing companies. The majority of final projects are carried out under the supervision and in a continuous cooperation with a university teacher and, as a rule; theoretical or practical research carried out by a student is related to the themes of the supervisor's research. More active students choose their research theme and supervisor themselves depending on their research interests and willingness to master latest computer modeling technology. Those students, who are actively involved in research, prepare scientific publications together with their academic advisers and participate in various national and international scientific conferences. Many students participating at least in student-organized scientific conferences, where they could present their research findings, could gain scientific experience and practice their presentation skills.

Students have opportunities to participate in student mobility programmes. Indeed 28% of the graduates of *Theoretical Physics and Astrophysics* programme in the recent period of 5 years participated in student mobility programmes. However, Expert Team would like to see this remarkable number even higher in the future. Students claim that they receive good education at Vilnius University and think that ERASMUS studies misbalance their chosen study programme. Having returned from ERASMUS studies, they have to catch up with the rest of the students and finish research projects started, to attend lectures of theoretical courses for which they need the knowledge of the course units of the Faculty of Physics, which they missed during their leave. Nevertheless, the Expert Team strongly encourages the student mobility programme and thinks that with better preparation for the placement the students should not have major difficulties for their work after return.

The higher education institution ensures an adequate level of academic and social support. Some students are granted incentive-based scholarships for academic achievements. Previously as many as 30% of them would receive scholarships. As the financing procedures changed in 2009, around 13% of the students receive scholarships, which are of two types – regular (195 Lt) and increased (325 Lt). Need-based (social) scholarships can be allocated to those who are not so well off and are based on the student and family's financial record, and they are distributed by Students' Representation Office. If possible, students are employed in science projects, run by the department of Theoretical Physics and Astronomical observatory trying to find a research field related to the their master studies' research theme.

The assessment system of students' performance is clear, adequate and publicly available. The procedures of student achievement assessment and coping with academic debts are defined in the regulations. The Procedures of Student Achievement Assessment are approved by the VU Senate Committee. Specific assessment methods of each course unit are outlined in course unit descriptions and explained to students in the introductory lecture for each subject.

Professional activities of the majority of graduates meet the programme providers' expectation. A large part of the graduates (sometimes even up to 100%) continue their studies in the third cycle - doctorate level (at Vilnius University, at various institutes of Natural Sciences and Technology Center, other Lithuanian or foreign universities).

6. Programme management

Responsibilities for decisions and monitoring of the implementation of the programme are clearly allocated. The study programme is managed by the Study Programme Committee, which is formed from the staff of the Faculty of Physics, the students recommended by Students' Representation Office, department Faculty of Physics and the representatives of social partners. The Head of the Study Programme Committee is elected from the Committee members by the majority of votes. The Study Programme Committee approves course-unit descriptions, previously approved at department meetings, and proposes to the Faculty Council to approve the changes in the programme or changes in the admission procedures. The heads of departments inform the Study Programme Committee about the shortcomings in the programme and possible ways of solution (the Heads of departments are informed by the teachers). The Head of the department is in charge of the quality of course-units related to the profile of the department and the study course of these course-units. The implementation of the study programme is administered by the Dean's office, i.e. the Dean and the Vice-Dean for academic issues. Programme administration issues are discussed at weekly meetings in the Dean's office.

Lectures/seminars by freshly employed staff at outside institutions/companies are acknowledged and should be continued. This will help in motivation of students (and staff). This will also bring concrete examples how/where the theoretical knowledge can be applied, what are the challenges and issues, where this theory can make the difference in practice.

Information and data on the implementation of the programme are regularly collected and analysed. The Dean's office receives information about issues or problems with the programme from the representatives of students' self-governance. Surveys are organised to help to get feedback. Students have been surveyed online after each semester (after they had already taken their examinations). These surveys are organized by the VU Quality Management Centre. The outcomes of internal and external evaluations of the programme are used for the improvement of the programme.

Having analyzed the survey data, the study committee of *Theoretical Physics and Astrophysics* and the faculty administration in their meetings together with the students try to find out the reasons of possible dissatisfaction and, if there is a need, make corrections to the number of hours or content of a certain course unit, introduce new course units, modernize teaching laboratories, invite teachers from companies or organizations to deliver some course units as well as try to involve young employees in teaching activity who most often have just come from abroad or gained a doctor's degree at the university. The evaluation and improvement processes involve also various stakeholders.

The internal quality assurance of the programme has several right elements; however they do not come together in a well-established system. It is necessary that the programme management adapt a functioning quality assurance method in the near future.

III. RECOMMENDATIONS

1. The programme should make efforts to enhance the mobility and staff exchange, in particular for students. Various available instruments can be used for this purpose, for example, ERASMUS grants, project research grants, bilateral agreements between institutions, etc.
2. The programme should continue and strengthen their efforts in providing courses in English. This should be the case if the students' group involves some foreign students. In this regard, the programme might be promoted as capable to offer lectures and practical courses in English. Equally, invitation of more guest lecturers and scientists is strongly encouraged. Finally, students should have a chance to give a seminar or conference presentation in English.
3. The internal quality assurance of the programme is one of the most important prerequisite to maintain its sustainability. Therefore it is recommended that the programme management builds up a closed and detailed system of quality assurance and quality control. It should include all aspects of curriculum development, staff renewal and further training of the members, the review of material resources and all other aspects of the study process. This quality assurance system should interlock in those of the Faculty of Physics and of the Vilnius University.
4. The final thesis composing needs additional attention. The knowledge of presenting results should be strengthened by additional course/seminar dedicated to this topic, in particular explaining the format and structure of the diploma thesis work.
5. In support of the aim C, the curriculum should include additional and specific courses with practical examples how theory, algorithms, and computer modelling are applied in practice in the mentioned areas of “manufacturing, economics and expert activity”. This would allow students to link the theory with “real life” situations and enhance the synergy with computational physics.

IV. SUMMARY

The *Theoretical Physics and Astrophysics* study programme is a necessary and important member of the second cycle programme family at the Faculty of Physics of Vilnius University.

The study programme gives a good knowledge in master level physics and it is clearly sufficient to found the Master of Physics degree. The structure of the study is well thought through, it is of high and of up-to-date scientific level.

The environment and conditions for students are appropriate and the possibility to work on the supercomputer of the Faculty gives an excellent opportunity. The conditions are good even when compared to international practices. The teaching staff is well prepared and motivated. The age composition is appropriate in order to maintain sustainability. The students are bright, knowledgeable and motivated persons, they seem to be committed to science and computational physics.

The Expert Team, besides the appreciation, has several recommendations to the management of the *Theoretical Physics and Astrophysics* second cycle program.

The Expert Team suggests investigating of thinking through the connection with the curriculum design of the biology master programs including the serious consideration of the course “Astrobiophysics”.

The program should make efforts to facilitate and increase the mobility of students and staff exchange. This mobility is in fact very low. Various available instruments can be used for the purpose to change this unfortunate fact, like ERASMUS scholarships, project research grants, or bilateral agreements between institutions. The programme management should study possible other reasons and measures in order to enhance the mobility.

The programme management should continue and strengthen their efforts in providing courses in English. This should be the case if the students' group involves some foreign students. In this regard, the programme might be promoted as capable to offer lectures and practical courses in English. Equally, invitation of more guest lecturers and scientists is strongly encouraged. Finally, students should have a chance to give a seminar or conference presentation in English.

The internal quality assurance of the programme is one of the most important prerequisite to maintain sustainability. Therefore it is recommended that the programme management of *Theoretical Physics and Astrophysics* should build up a closed and detailed system of quality assurance. It should include all aspects of curriculum development, staff renewal and further training of the members, the material resources and all aspects of the study process. This quality assurance system should interlock in those of the Faculty of Physics and of the Vilnius University.

V. GENERAL ASSESSMENT

The study programme *Theoretical Physics and Astrophysics* (state code – 621F30004) at Vilnius University is given **positive** evaluation.

Study programme assessment in points by evaluation areas.

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	4
2.	Curriculum design	3
3.	Staff	4
4.	Material resources	4
5.	Study process and assessment (student admission, study process student support, achievement assessment)	4
6.	Programme management (programme administration, internal quality assurance)	3
	Total:	22

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;

2 (satisfactory) - meets the established minimum requirements, needs improvement;

3 (good) - the field develops systematically, has distinctive features;

4 (very good) - the field is exceptionally good.

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Team leader:

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Grupės nariai:
Team members:

Dr. Rynno Lohmus
Habil. dr. Danas Ridikas
Prof. habil. dr. Arvidas Galdikas
Darius Eidukynas

V. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus universiteto studijų programa *Teorinė fizika ir astrofizika* (valstybinis kodas – 621F30004) vertinama **teigiamai**.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	4
2.	Programos sandara	3
3.	Personalas	4
4.	Materialieji ištekliai	4
5.	Studijų eiga ir jos vertinimas	4
6.	Programos vadyba	3
	Iš viso:	22

* 1 - Nepatenkinamai (yra esminių trūkumų, kuriuos būtina pašalinti)

2 - Patenkinamai (tenkina minimalius reikalavimus, reikia tobulinti)

3 - Gerai (sistemiškai plėtojama sritis, turi savitų bruožų)

4 - Labai gerai (sritis yra išskirtinė)

<...>

IV. SANTRAUKA

Teorinės fizikos ir astrofizikos studijų programa yra būtina ir svarbi Vilniaus universiteto Fizikos fakulteto antrosios pakopos programų dalis.

Studijų programa suteikia išsamių magistrinio lygio fizikos žinių, kurių neabejotinai pakanka fizikos magistro laipsniui pagrįsti. Studijų programos sandara yra gerai apgalvota, programa atitinka aukštą šiuolaikinio mokslo lygį.

Studijų aplinka ir sąlygos yra tinkamos, studentai turi puikią galimybę dirbti su superkompiuteriu. Sąlygos yra geros net palyginus jas su tarptautine praktika. Akademinis personalas gerai pasirengęs ir motyvuotas. Amžiaus sudėtis yra tinkama tvarumui išsaugoti. Studentai gabūs, gerai nusimanantys ir motyvuoti, panašu, jog jie pasišventę mokslui ir kompiuterinei fizikai.

Ekspertų grupė, nepaisant palankaus *Teorinės fizikos ir astrofizikos* antrosios pakopos programos vertinimo, jos vadovams pateikia keletą rekomendacijų.

Ekspertų grupė siūlo ištirti, ar nereikėtų šios programos susieti su biologijos magistrantūros programų sandara, įskaitant astrobiofizikos kurso įtraukimą.

Įgyvendinant šią programą, reikėtų pasistengti padidinti studentų judumą ir apsikeitimą darbuotojais. Judumas iš tikrųjų labai mažas. Yra įvairių priemonių šiai problemai išspręsti, pavyzdžiui, ERASMUS stipendijos, mokslinių tyrimų projektams skirtos dotacijos ir institucijų dvišaliai susitarimai. Programos vadovai turėtų ištirti kitas galimas mažo judumo priežastis ir priemones judumui padidinti.

Programos vadovai turėtų ir toliau stengtis dėstyti dalykus anglų kalba. Tai turėtų būti daroma, kai studentų grupėje yra užsieniečių. Šiuo atžvilgiu programa galėtų būti reklamuojama

kaip galinti pasiūlyti paskaitas ir praktinį kursą anglų kalba. Be to, primygtinai raginama pasikviesti daugiau atvykstančiųjų dėstytojų ir mokslininkų. Pagaliau ir studentams turėtų būti suteikta galimybė pristatyti seminarą ar konferenciją anglų kalba.

Viena iš svarbiausių programos tvarumo išsaugojimo prielaidų yra jos vidinis kokybės užtikrinimas. Todėl rekomenduojama, kad *Teorinės fizikos ir astrofizikos* studijų programos vadovai sukurtų uždara ir išsamią kokybės užtikrinimo bei kokybės kontrolės sistemą. Ji turėtų apimti visus programos tobulinimo, personalo atnaujinimo ir tolesnio jų mokymo klausimus, materialiuosius išteklius ir visus kitus studijų proceso aspektus. Ši kokybės užtikrinimo sistema turėtų būti sujungta su Fizikos fakulteto ir Vilniaus universiteto sistemomis.

<...>

III. REKOMENDACIJOS

1. Įgyvendinant šią programą, studentų labai reikėtų pasistengti padidinti judumą ir apsikeitimą darbuotojais. Šiam tikslui galima pasinaudoti įvairiomis priemonėmis, pavyzdžiui, ERASMUS stipendijomis, mokslinių tyrimų projektams skiriamomis dotacijomis, dvišaliais institucijų susitarimais ir t. t.
2. Įgyvendinant šią programą turėtų būti ir toliau didinamos pastangos dėstyti dalykus anglų kalba. Tai turėtų būti daroma, kai studentų grupėje yra keletas užsieniečių. Šiuo atžvilgiu programa galėtų būti reklamuojama kaip galinti pasiūlyti paskaitas ir praktinį kursą anglų kalba. Be to, primygtinai raginama pasikviesti daugiau atvykstančiųjų dėstytojų ir mokslininkų. Pagaliau ir studentams turėtų būti suteikta galimybė pristatyti seminarą ar konferenciją anglų kalba.
3. Viena iš svarbiausių programos tvarumo išsaugojimo prielaidų yra jos vidinis kokybės užtikrinimas. Todėl rekomenduojama, kad programos vadovai sukurtų uždara ir išsamią kokybės užtikrinimo ir kokybės kontrolės sistemą. Ji turėtų apimti visus programos tobulinimo, personalo atnaujinimo ir tolesnio jų mokymo klausimus, materialiuųjų išteklių peržiūrą ir visus kitus studijų proceso aspektus. Ši kokybės užtikrinimo sistema turėtų būti sujungta su Fizikos fakulteto ir Vilniaus universiteto sistemomis.
4. Daugiau dėmesio reikia skirti baigiamųjų darbų rašymui. Reikėtų geriau susipažinti, kaip pateikti rezultatus, tam tikslui rengiant papildomą kursą ir (arba) seminarą, skirtą šiai temai, ypač diplominio darbo formatui ir struktūrai išaiškinti.
5. C tikslui sustiprinti į programą turėtų būti įtraukti papildomi ir specialieji dalykai su praktiniais pavyzdžiais, kaip taikyti teoriją, algoritmus ir kompiuterinį modeliavimą minėtose „gamybos, ekonomikos ir ekspertinės veiklos“ srityse. Tai padėtų studentams susieti teoriją su „realaus gyvenimo“ situacijomis ir sustiprint sinergiją su kompiuterine fizika.