Ilia State University
Faculty of Natural Sciences and Medicine
Program Level - Master
Physics and Astronomy
Curriculum

Faculty/School	**Faculty of Natural Sciences and Medicine**
Program Title	**Physics and Astronomy**
Academic Degree Awarded	The Degree of Master of Physics
Program Duration/ECTS	4 semesters, 120 credits (1 credit - 25 hours)
Launching Date of the Program & Program Update	The program was developed in 2011 and updated in 2020. The program can be updated at the beginning of each academic year.
Language of Instruction	Georgian
Head/Heads of the Program	Andria Rogava, associate professor Giorgi Japaridze, professor Teimuraz Zakarashvili, professor Tinatin Kakhniashvili, professor Zurab Tavartkiladze, associate professor Nunu Metreveli, associate professor Maya Thodua, Associate Professor

Admissions Requirements

Admission to the master's degree is based on the results of the Unified Master's Examinations and written and oral university entrance exams. Physics and mathematics knowledge will be assessed at the written university exam. The motivation, communication and argumentative reasoning skills will be assessed with the oral exam, as well as the knowledge of the English language at the B1 level will be tested. The academic performance at the previous level and, if available, research and/or work experience, will be taken into account during the competition.

Applicants to the Master's program must have a Bachelor's degree/academic degree equivalent to a Bachelor's degree in Physics, Mathematics, Information and Communications Technology and Engineering.

Information about the conditions, requirements, assessment components and criteria of the entrance exams is given in detail in the “Program Admission Document” and can be found on the website of the university under the heading “Admission”.

Program Objectives

The objective of the program is to train a new generation of researchers who have deep and systematic knowledge of current issues, modern approaches and methods in physics and/or astronomy, specialize in one of the areas offered by the program (elementary particle physics, theoretical astrophysics, cosmology and gravitation, condensed matter physics, astronomy-astrophysics, atmosphere and ionosphere physics, biophysics) and can independently conduct research in the chosen field, which creates a prerequisite for the graduate to be competitive both in the labor market and at the next level of study.

Learning Outcomes

The graduate:

1. demonstrates deep and systematic knowledge of the fundamental laws and principles of physics, as well as actual issues, achievements, and problems in the chosen field (Elementary Particle Physics);
2. can use numerical and analytical mathematical methods for theoretical models of physical phenomena and to solve complex problems of physics, with the use of computer programs as well;
3. can conceptually describe complex physical processes, process data, and interpret obtained results;

4. can plan and conduct a theoretical/experimental/observational or combined research project using appropriate tools and methods within the chosen concentration in compliance with the norms of scientific research ethics;
5. can critically analyze the results and draw informed conclusions;
6. can effectively communicate research results and conclusions to academic and general audiences by adhering to the principles of academic integrity and using information technologies;
7. can independently manage the learning and research process, express scientific vision and approach.

Program Structure

The student chooses one of the concentrations (elementary particle physics, theoretical astrophysics, condensed matter physics, astronomy-astrophysics, cosmology and gravitation, atmosphere and ionosphere physics, biophysics) within the Master's program: Physics and Astronomy.
Students of all concentrations must

- take compulsory courses of the common block - 30 credits (PHYSGEN)
- prepare and defend master's thesis during the fourth semester - 30 credits

With regard to the chosen concentration, the student must accumulate 90 credits in accordance with the following structure:
Elementary Particle Physics

- Compulsory courses - 42 credits
- Elective courses - 18 credits
- Master's thesis - 30 credits

Theoretical Astrophysics

- Compulsory courses - 30 credits
- Elective courses - 30 credits
- Master's thesis - 30 credits

Condensed Matter Physics

- Compulsory courses - 30 credits
- Elective courses - 30 credits
- Master's thesis - 30 credits

Astronomy-Astrophysics

- Compulsory courses - 42 credits
- Elective courses - 18 credits
- Master's thesis - 30 credits

Cosmology and Gravitation

- Compulsory courses - 30 credits
- Elective courses - 30 credits
- Master's thesis - 30 credits

Atmosphere and Ionosphere Physics

- Compulsory courses - 30 credits
- Elective courses - 30 credits
- Master's thesis - 30 credits

Biophysics

- Compulsory courses - 36 credits
- Elective courses - 24 credits

Master's thesis - 30 credits

Teaching Methods

- Lectures;

- Seminars;
- Analysis and synthesis;
- Written method;
- Modeling;
- Practical method;
- Laboratory method;
- Discussion/debate;
- Demonstration method;
- Guidance/supervision.

Note: The teaching methods used in the program are specified in the syllabi of the respective courses.

Student Assessment

The assessment is based on a 100-point system.
Points are distributed according to the following scheme in the grading system:
(A) 91-100 Excellent
(B) 81-90 Very Good
(C) 71-80 Good
(D) 61-70 Satisfactory
(E) 51-60 Sufficient
(FX) 41-50 Did not pass – 41-50 points of the maximum grade, which means that the student is required to work more to pass and is allowed to retake the exam once through independent work
(F) 0-40 Fail – 40 points and less of the maximum grade, which means that the work done by the student is not enough and he/she has to retake the course
Assessment components, criteria and assessment methods are specified in the syllabi of the training courses.

Employability

Master of physics can continue his/her studies at the next level of higher education - a doctorate and/or get a job:

- at the university or scientific-research institutions in Georgia and abroad; in educational institutions.

In accordance with the fields:

- **For graduates of astronomy-astrophysics, atmosphere and ionosphere physics concentrations:** astronomical observatories, astronomy and astrophysics related scientific research institutions (see www.aas.org). Public and private structures (where statistics, data analysis and modeling are required).
- **For graduates of atmosphere and ionosphere physics concentration:** atmospheric-ionospheric scientific-research institutions and observatories, regional and global climate change monitoring centers, air navigation, hydromet centers.
- **For graduates of elementary particle physics, cosmology and gravitation, theoretical astrophysics concentrations:** research and applied sector of information technology and electronics; Organizations that require computer processing-modeling and statistical analysis of information (data), other fields of physics and beyond.
- **For graduates of condensed matter physics concentration:** scientific-research and training institutions working in physics and related areas, high-tech materials science, nanoelectronics and nanoengineering research laboratories and industry; Structures engaged in patent activities in the

nanotechnological field; Laboratories and commercial structures working on both theoretical and IT-engineering issues of computing systems.

- **For graduates of biophysics:** scientific institutions of biomedical field; Clinical-diagnostic centers. As a result of the acquired skills, the graduate will be able to work effectively outside the scope of physics (new technology, analytical services, etc.)

Teaching and Learning Resources

- Lecture halls;
- Educational laboratories;
- University library and databases of electronic journals;
- Computer labs;
- Electronic selection system of the university – "Argus";
- Elearning, Turnitin.
- Center for Condensed Matter Theory and Computational Quantum Physics
- Computing center
- Computer programs: Maple, Matlab, IRAF, IDL, Phyton;

Also, material and technical base of the university and other research centers and institutes:

- Institute for Theoretical Physics
- Institute of Applied Physics
- Institute of Biophysics
- Evgeni Kharadze Georgian National Astrophysical Observatory

Partner organizations:
LEPL Tbilisi N42 Public School of Physics-Mathematics named after Academician Ilia Vekua
LEPL Institute of Micro-and Nanoelectronics