

**The master's program**  
**«Physics of Neutrinos and**  
**Fundamental Interactions**  
**of Elementary Particles»**  
**in the direction of MM «Physics»**  
**(2023/2024)**

Scientific Supervisors of the Program:

Professor A.I. Studenikin and Professor K.A. Kouzakov,

Scientific Secretary: K.L. Stankevich/

**1.1. Specialized competencies of the master's program «Physics of Neutrinos and Fundamental Interactions of Elementary Particles»:**

1. The ability to apply advanced research methods to current problems in the field of neutrino physics and fundamental interactions of elementary particles (M-СПК-1).
2. The ability to analyze and perform calculations within fundamental aspects in the field of neutrino physics, problems of massive neutrinos and neutrino oscillations (M-СПК-2).
3. The ability to set specific research tasks in the field of application of modern methods of theoretical and mathematical physics, as well as to develop and apply methods for processing experimental data in the field of neutrino physics and elementary particle physics (M-СПК-3).

## Disciplines of the original part of the master's programs

### 1.2.1 Mandatory disciplines of the master's program

The labor intensity of the variable part according to the Educational Standard: 46-51 credit units.

The complexity of the variable part of the curriculum: 49 credit units.

The complexity of the master's program: 47 credit units.

	<b>Laboriousness (complexity in credit units)</b>	
<b>Mandatory disciplines of the master's program</b>	<b>Complexity credit units</b>	<b>Specialized competencies</b>
Quantum field theory	6	M-CIHK-1
The standard model and its extensions	6	M-CIHK-2
Introduction to neutrino physics	3	M-CIHK-3
The theory of the fundamental interactions of hadrons	2	
Introduction to group theory	5	
Electromagnetic interactions of neutrinos in external fields and dense media	4	
Experimental neutrino physics	2	
High-energy astrophysics	2	
Particle physics at colliders	2	
Quantum collision theory	2	
Interaction of particles and radiation with matter	2	
<b>Disciplines of the master's program at the student's choice, credit units</b>	<b>18</b>	

**1.2.2. The sample list of master's program disciplines «Physics of Neutrinos and Fundamental Interactions of Elementary Particles» at the student's choice \*\***

<b>Discipline</b>	<b>Complexity credit units</b>
Interaction of particles in external fields	2
Quantum field theory at a finite temperature	2
Quantum field theory in curved space-time	2
Supersymmetry	2
Methods of group theory in elementary particle physics	2
Neutrino mass generation models	2
Effective models in quantum field theory	2
Machine learning for processing experimental data	2
Analysis of experimental data in particle astrophysics	2
Electromagnetic interactions of neutrinos in external fields and dense media	4
Neutrino scattering in matter	2
Modern methods for analyzing experimental neutrino data	2
Advanced course in quantum physics: open systems theory	2
The Coulomb interaction of the fundamental particles and its role in quantum physics	2
Neutrino astrophysics	2
Modern methods of neutrino detection	2

\*- the student can choose a discipline of another master's programs, read in the framework of other master's programs at the student's choice, in the amount of no more than 8 credit units

\* The list of disciplines is approved by the Scientific Council of the Faculty of Physics before the beginning of the academic year.

Dean

Faculty of Physics of Moscow State University

Professor N. N. Sysoev