Tickets for the course “Introduction to Cosmoparticle physics"

(Open Online Course for PhD Programme on Fundamental physics)

Tickets 1-6

1.
1. Small thesis
2. Gravitational lensing . Objects MACHO.
3. Galactic cosmic rays: spectrum, anisotropy, mass composition.

2 .
1. Small thesis
2. Search for dark matter particles (list) .
3. Cosmoarchelogy

3 .
1. Small thesis
2. Effects of accumulation and annihilation of WIMPs in the Earth and the Sun.
3. Primordial Black holes

4 .
1. Small thesis
2. WIMP- nucleon interaction . WIMP searches in underground experiments .
3. Antimatter in baryon asymmetric Universe

5 .
1. Small thesis
2. Gamma-ray astrophysics. Cherenkov effect and it’s application in gamma-ray detection.
3. Homotopically stable objects

6.
1. Small thesis
2. Model of the Kaluza -Klein . Main consequences and possibilities to test.
3. Neutrino astrophysics: galactic and extragalactic contributions to astrophysical neutrino flux.

Tickets 7-12

7.
1. Small thesis
2. Cosmic rays of ultrahigh energies . Problem of their origin.
3. Inflation.

8.
1. Small thesis
2. Indirect detection of dark matter. WIMPs.
3. Baryosynthesis.

9.
1. Small thesis
2. The idea of solving the hierarchy problem of energy scales in multidimensional theories (" low-energy gravity ").
3. Dark Atoms

10 .
1. Small thesis
2. ADD type models. Main consequences and the possibility of their test at accelerators
and in cosmology
3. Primordial nonlinear structures

11.
1. Small thesis
2. Branes
3. Signatures of electron, muon and tau astrophysical neutrinos in neutrino detectors.

12.
1. Small thesis
2. Gamma-ray horizon. Absorption of gamma-rays on on extragalactic background light.
3. Cosmophenomenology of new physics

Additional questions

To improve the result of the exam there can be offered a question on the small thesis or one of the following questions :

1. Experiment XQC as a probe for dark matter particles.
2. Cosmic positrons and antiprotons as a detector of exotic sources.
3. Cosmic rays of medium and high energy as a possible manifestation of new physics.
4. PBH evaporation
5. Models of composite dark matter
6. O- helium, advantages and problems of the model
7. Constraints on the mass of neutrino
8. Constraints on the number of neutrino species
9. Cutoff in the cosmic ray spectrum: Greizen-Zatsepin-Kuzmin effect.
10. 2 million year SN as solution of positron and anti-proton excess, anomaly in cosmic ray anisotropy and proton to He ratio
11. Indirect detection of dark matter. Heavy neutral leptons.
12. Indirect detection of dark matter. Axion-like particles.