Dark matter and dark energy

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Language of study: **Russian**
Mode of study: **full-time**
Duration: **2 years**
Availability of free education: **no**
Price: **2 300 USD per year**

In the last decade, astrophysics, cosmology and high-energy physics have made tremendous strides: such things as gravitational waves, black holes, and the Higgs boson have been discovered. However, the most important breakthrough of the late 20th and early 21st centuries was the discovery that only 5% of the observable universe consists of atoms. The remaining 95% is the "dark something" (sometimes called the "dark sector"), which consists of two very different components known as "dark matter" and "dark energy". The most ambitious and fascinating task facing modern science is to explain what that is. All over the world, research is conducted on that topic. It is at the very forefront of science and is supported by numerous grants. There is no doubt that the names of those scientists who can understand the nature of "dark matter" and (or) "dark energy" will be preserved in history.

A remarkable feature of this field of research is that it combines two completely different fields: the science of the smallest (elementary particles) and the largest (cosmology) things - those who study the "dark sector" should understand both the physics of the microcosm and astrophysics and cosmology, both in terms of the theoretical foundations and in the experimental data obtained at large accelerators (such as LHC) and space telescopes (such as WMAP).

During the course of study, you will learn the basics of elementary particle theory and, at the same time, astronomy; elements of quantum field theory and relativity theory, the physics of black holes and gravitational waves. You will get acquainted with the most unconventional but very popular trends, such as string theory and the multidimensionality of space, theories of the cosmological inflation and the multiverse. You will be able to understand the design of accelerators and space telescopes, as well as the methods of processing extremely large data obtained using these devices. Effective processing of such arrays of information is no longer possible without the use of artificial intelligence systems and trained neural networks. A feature of modern research that distinguishes it from the traditional academic approach is the ability to professionally write code in high-level programming languages (such as Python), be able to train a neural network, use TensorFlow and understand genetic algorithms.

Having mastered modern theoretical and experimental methods of processing data obtained from space telescopes and large accelerators, you will automatically become a professional in the field of big data and artificial intelligence. This will make it possible for graduates to work not only in the field of the "dark sector", but also in any IT field focused on Industry 4.0. However, what can compare to trying to understand the nature of "dark matter"?

Studying takes place both traditionally and in an online format. IKBFU has its own school of cosmology and astrophysics (featuring two doctors of science, three holders of a candidate's degree, one PhD), which works in close collaboration with leading scientists from Russia, Spain, Italy, England, Germany, Poland, and the United States. You will meet many of these professionals in their personal classes. You will also be able to attend guest lectures read by professionals with the highest citation indexes in the world (for example, with h-indexes of about 90) - something you will not be able to find in the other master's courses.

Specializations within this programme