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NEW AREA OF NANOTECHNOLOGY – NANOPLASMONICS

Nanoplasmonics is the science of optics at the nanometer scale. The subject of nanoplasmonics study is the optical properties of metallic particles and nanostructures, which are caused by oscillations of electrons relative to the crystal lattice. Plasmonics typically uses the so-called surface plasmon polaritons, which are electron oscillations that propagate an electromagnetic wave along the interface between a dielectric and a metal.

The first scientific works devoted to plasmon oscillations in nanoparticles and nanostructures appeared at the beginning of the 20th century. Major development in technology over the past decade opened opportunity for this sphere to be improved. In recent years, scientists have been actively creating and studying the properties of so-called metamaterials – artificial structures made of many individual pieces or nanoparticles that are capable of interacting with light or other forms of electromagnetic radiation in unusual ways. Research of these materials currently covers physical, chemical, biological and other branches of world science.

Nanoparticles in medicine are one of the most popular objects of modern science. Introduction of nanotechnology into diagnostic methods and therapy makes it possible to monitor simultaneously the disease and treat it using only one tool - nanoparticles.

Another area of application of nanoparticles is energy. The main problem of modern energy is the search for alternative energy sources other than those based on fossil fuels. These include, first of all, the Sun. The use of solar energy occurs by its conversion using photovoltaic, photochemical or photothermal nanoparticles.

Another area of use for metal nanoparticles is information technology. However, the diffraction effect in such optical systems limits the minimum dimensions of the elements to half the length. This limitation can be circumvented

by using plasmon-polariton waves, the length of which is much smaller than the wavelength of light, and the significant cross section of absorption and scattering of these waves allows detecting insignificant signals. As a result, nanoparticles can be used to create optical waveguides, antennas, lenses and resonators.

In modern day nanoplasmonics can take place as one of the most prevalent research areas.