



World of MEPhI

OUR «KNOW-HOW»



Research developments of MEPhI students, postgraduates and young scientists have attracted wide interest not only of Russian but also foreign media community. Since the beginning of this year television and print media have published more than 200 publications, TV stories, telling about the achievements of our guys. See pages 4-6

«ROBOTICS» LABORATORY IN MEPHI WORKS OUT PROSTHESIS PROTOTYPE USING MODERN TECHNOLOGY OF RAPID PROTOTYPING

Faculty laboratory "Robotics" of the Department of Computer Systems and Technologies in MEPHI has worked out a prosthesis prototype using modern technology of rapid prototyping on demand of Motorica company which has significantly lowered the price and made the prosthesis more ergonomic.

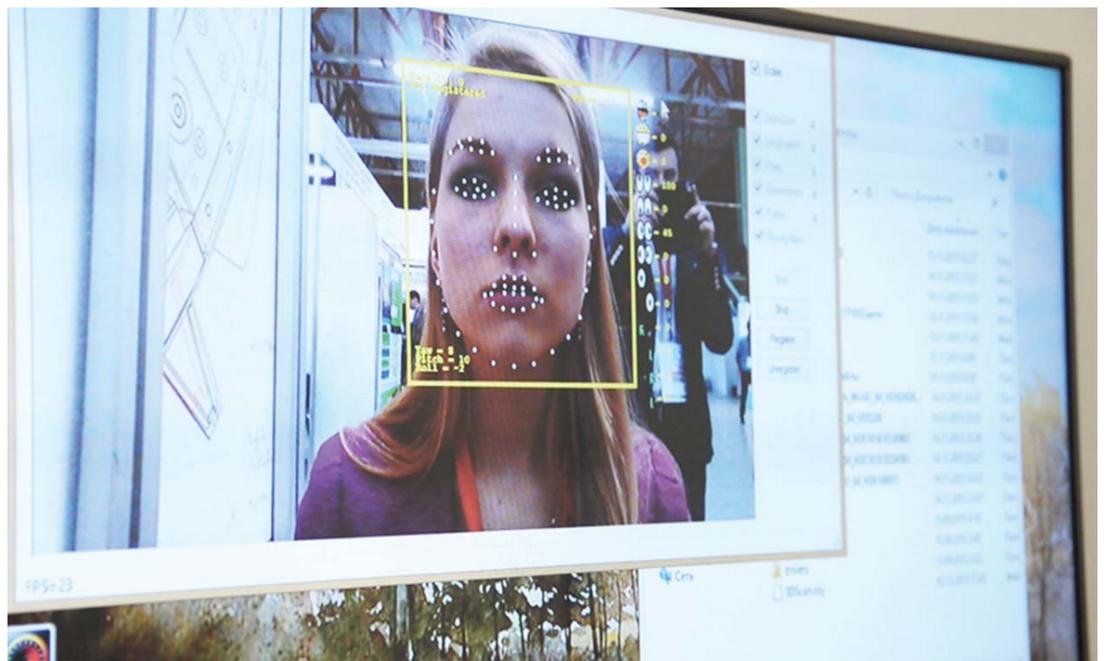
Mechanical and electromechanical prostheses practically are not worked out in Russia, and the ones which are made cost unjustifiably much and virtually are not developed.

There is another novelty, a system of remote myo-control which uses computing power of modern

smartphones. Such type of control has not been used in prostheses so far.

The project solves the problem of availability of cheap upper limb functional prostheses on both Russian and foreign markets. Its aim is to develop an electromechanical prosthetic hand managed by muscle contractions. During research and development works 3D printing has been widely used which help to lower costs significantly at the development stage. The prosthesis should repeat the functioning of the hand to let people live totally.

"Our prostheses will cost more than 50 % less than the closest analogues, the timer of construction and installation will reduce more than twice (a week), will have a remote control capacity. Prosthetist doctors claim that our prostheses are more convenient, functional and psychologically more acceptable than existing Russian analogues. Global competitiveness is moderate because prostheses have been worked out and financed for a long time in the world. The competitiveness in Russia is high. There is a prospect of total import substitution in this sphere", - said Vladimir Danshin, post-graduate student of the Department of Computer Systems and Technologies in MEPHI.



MEPHI TO HELP BANKS TO IDENTIFY LIARS

Young scientists at the Robotics laboratory in MEPHI has created a unique device that allowing to remote identification of human behavior, a non - contact lie detector and face recognition system.

Both projects are focused on the common task - the reduction of risks for financial organizations. Face recognition is common used in the task of avoid fraudsters to conclude repeat business with the Bank, thereby reducing the risks of non-return of con-

sumer and mortgage loans. Also security systems that studies human behavior, actively used in law enforcement, psychology and HR departments.

The basic idea of the prototypes created in MEPHI – scanning a number of physiological parameters in video. If a person is nervous or actively comes up with answers to tough questions, his reflexes, delayed responses, facial expressions, heart rate and respiratory rate are subject to change.

The system records changes to 22 markers on the face and chest.

Contactless lie detector has already been successfully tested on hundreds of people who were given 20 questions. Recognition accuracy of people answers on this sample was 65-75%, depending on the quality of the video material.

In the nearest months, scientists are going to start integrating contactless test types of lie detectors in business processes.

TRIUMFai INTERNSHIP

Dmitry Bazyl, a 2016 graduate of the Department № 14: "I have passed a pre-diploma practice at the Canadian National Laboratory TRIUMF (Vancouver), where spent 4 months. The internship became pos-



sible due to the scholarship of the President of the Russian Federation to study abroad.

This laboratory is actively working on testing new superconducting alloys for accelerating structures. The use of new materials in the field of superconductivity can enhance the electrodynamic characteristics of accelerating structures and reduce the cost of their production. I had the task of creating a superconducting HF resonator for testing superconducting ellipsoidal samples in operation conditions. Together with my local scientific supervisor, Candidate of Technical Sciences Vladimir L. Zvyagintsev we suggested the idea of using a coaxial resonator, operating at a fre-

quency of 3.4 GHz. The first analyses showed that the proposed structure is not only equal to the existing in other scientific organizations, but also surpasses them in some parameters. Then I have carried out HF calculations, investigated the phenomenon of secondary emission (multipacting discharge), mechanical calculations, as well as the calculations associated with the device to input power in the resonator. The results are reflected in my thesis project.

I really enjoyed this trip. I got a lot of experience, including with superconducting resonators. There is a great lab in Canada, and the country is beautiful. However, I see my future in Russia.



NEW METHOD OF TOOTH CONSTRUCTION MANUFACTURING – LASER MILLING – WORKED OUT IN MEPHI

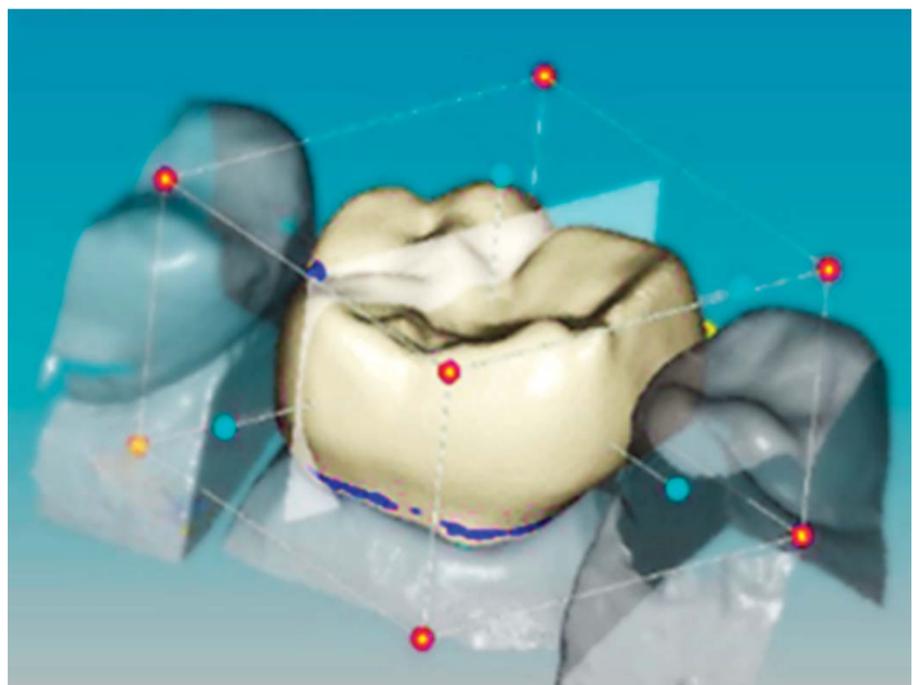
MEPHI Laser Center post-graduate student Artur Andreev has worked out a new technology of laser milling for tooth construction manufacturing.

Stomatological prosthesis market develops actively every year. Traditional ways of ceramic samples manufacturing, in particular mechanical milling, appear to be ineffective to fulfill tasks. They show low efficiency, require substantial expenditure for tooling, manual labour and don't provide enough flexibility in modeling and getting necessary tooth constructions. New technologies for high-speed and effective forming of ceramic crownworks and dentures of complex shapes, dental plates of small thickness are required.

Laser milling is an alternative technology to mechanical milling and has a lot of technological and economic advantages. Laser irradiation in near infrared range of wave-length offers great oppor-

tunities for making new ways of material processing for modeling and getting different types of crownworks and dentures.

Nowadays laser metalcutters can't be applied on a wide scale because of low project financing. However, the prognosis shows that the expenditures will quickly pay off. At first, lasers don't have consumables unlike dental cutters with chemical vapour deposition diamond coating which need to be changed from time to time because of their wear-out. Secondly, lasers have an advantage of thin-walled construction manufacturing, i.e.50-100 microns. Such plates look like natural teeth in any lighting. Mechanical works produce such effect only by lamplight. Thirdly, laser treats materials more carefully. It saves time, increases the accuracy and lowers the price of the denture. These are the main benefits of the laser technology.



MEPHI STUDENT OF NEVOD CENTRE BECOMES LAUREATE OF RUSSIAN ACADEMY OF SCIENCES 2015

Yurina E.A. who is doing a Master's degree in NEVOD centre has been awarded a medal of Russian Academy of Sciences and a prize for students in a nuclear physics competition in 2015 for her work "Energy-release of mu-meson groups in a water Cherenkov detector NEVOD".

Russian Academy of Sciences has announced the results of 2015 competition for young scientists and students ("Poisk" newspaper, № 3 (1389), January 22, 2016). These competitions are held annually to support young researches in 19 main areas of natural, technical and humanitarian sciences. Yurina E.A. has been awarded a medal in nuclear physics.

She graduated from The N.G. Basov Higher School of Physicists and entered new NEVOD program "Physics of particles of high and extra high energies".

She has done the work under the supervision of Kokoulin R.P. as a part of her Master's program where she researched energy-release of mu-meson groups in a water Cherenkov detector NEVOD. It's the first time when energy-release of mu-meson groups is measured in an interval of a zenith angle 55° - 85° and its growth is experimentally registered with the increase of the zenith angle. That's how a new approach to mu-meson problem has been realized – an excess of mu-mesons in broad air showers under extra- and ultrahigh energies (10^{15} - 10^{19} eV) which isn't explained by existing models of interaction even supposing iron structure of primary cosmic rays. This data is a good basis for dividing nuclear-physical and cosmo-physical reasons for the excess of mu-mesons.



MEPHI CREATES ROBOTIC COMPLEX «CHAIR» FOR DISABLED PEOPLE

The Laboratory of Robotics at the Department №12 has been developing the project "The Chair", which is performed with grant support from the Russian Foundation for basic research. Developed hardware and software robotic complex "Chair" allows to control the system via a brain-computer interface (BCI), voice commands and gesture operator-invalid.

«Chair» can be managed even by completely paralyzed people.

Besides, by reading the signals of the cerebral cortex, recognizing gestures and voice commands, the system operates more precisely and safely, as it has several channels of communication with the person.

This breakthrough is not simply compensating the person lost abilities, but gives some new capabilities which are not «in the basic configuration». This suggests that the future is moving from fiction into reality.

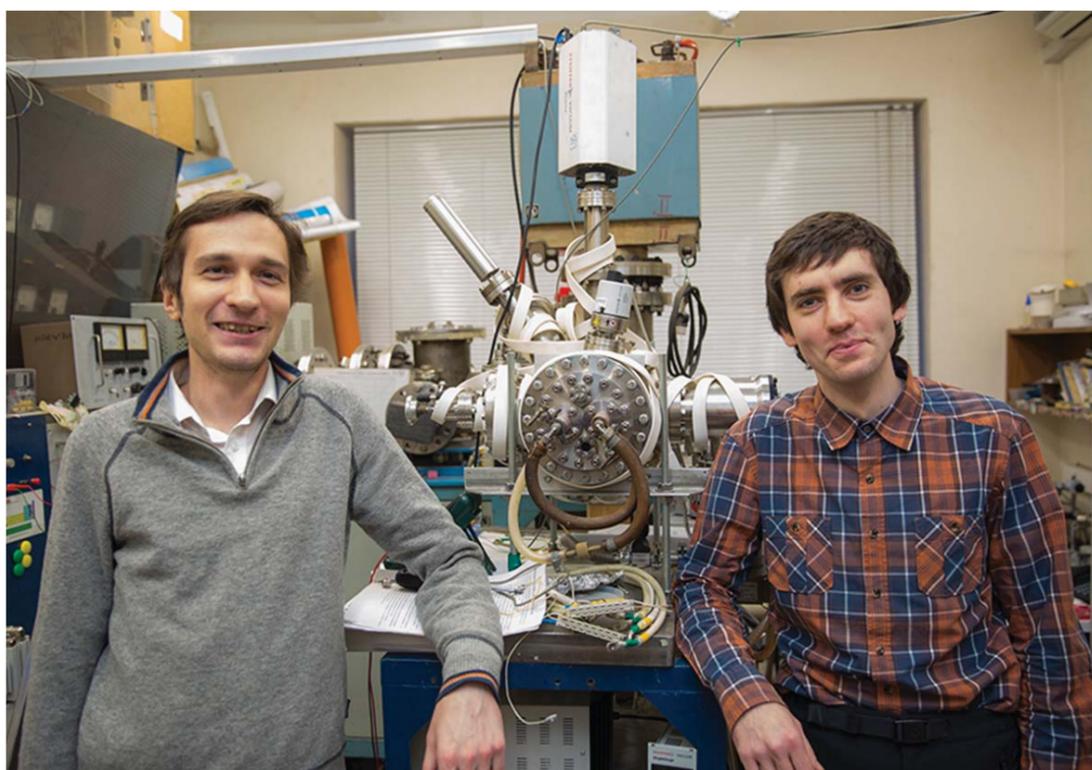


MEPHI DEVELOPS SIMPLE MODEL TO SCREEN PLASMA FACING MATERIALS OF TOKAMAKS BY EVAPORATED SUBSTANCE

The Department «plasma Physics» MEPHI has developed a simple model for screening the plasma facing materials of tokamaks by evaporated substance. Problems of interaction of the plasma with the surface of the walls of future fusion reactors occupy a key position in the ongoing program of controlled thermonuclear fusion. It is now known that during ELMs on the wall of the tokamak affects a huge pulsed heat loads, that can not only melt but also vaporize its surface layer. The vaporized material remains some time near the surface. Ionizes, he turns into a cloud of plasma consisting of heavy wall material and decrease the amount falling on the wall energy by conduction and re-emission.

In the theoretical group of the Department №21 the

work on the development of an adequate theory of shielding. A recently developed simple model, from which it is visible, that with growth falling to wall energy share absorbed in the plasma goes to saturation. This effect is observed experimentally on equipment of the CPMS type. Calculations according to the developed model enabled to explain some of the experimental dependence. It is interesting, for example, that the saturation energy is determined mainly by the properties of the wall material, its thermal conductivity and the energy of evaporation. In this case, the radiative transfer and the dynamics of the cloud of evaporated material is logarithmically weak effect on the amount of energy saturation.





MISS MEPhi-2016!

A large team of organizers, 30 the boldest and most beautiful contestants, two days of heavy casting and just one name: "Miss MEPhi-2016" – a contest, which wasn't held in our University for about three years.

What should a modern young lady be? Ideally she meets many requirements: combines wit and beauty, talent and erudition, has a wide range of interests and, of course, easily solve the integrals. The organizers of the contest "Miss MEPhi-2016" want to find a student who will be worthy to have the title.

On 12th and 18th of November at the first competitive stage, 30 girls were able to try

their hand. Participants had to tell about themselves, to showcase their talents and answer a few tricky questions. In addition, the jury assessed the appearance of young ladies, their charm and ability to hold the stage. The contest rules stated that only 12 girls can enter the next phase. However, after the casting it became clear that the choice won't be easy, and we will see really absorbing contest. In the video-contest participants projected themselves into a character from favorite Russian films, the name of which the viewer guessed from the film clip. At the next stage the candidates will have to pass the sport standards and

to prove to everyone that "Miss MEPhi" is not only smart, beautiful, but also an athletic girl. During the preparation for the final stage there will be master classes in fashion shows and common entrance to the stage.

If you still think that there is no beautiful girls in MEPhi, then come to the final of the contest "Miss MEPhi – 2016", which will be held in mid-April. You will see a terrific show where girls participate in creative and intellectual competitions, fashion shows.

All the details about the contest "Miss MEPhi-2016" you can find in the official community group: <http://vk.com/missmephi>.

