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## MESSAGE FROM NEIL B. GODICK

At the start of 2012, 55% of Russians used the internet. And, 36% of Russians used the internet daily.

Based on a February survey, 82% of Russian internet users are registered on at least one social networking site. Last year only 52% of internet users were connected to a social network.

Demographics of social networks users: 96% are between 18 and 24, 87% are comfortably well off, and 95% live in Moscow and St. Petersburg (94%).

The most popular social networking sites on the Russian internet are: Odnoklassniki (Russian equivalent of Classmates) – 73%, VKontakte (Russian equivalent of Facebook) – 62%, and Moy Mir – 31%.

For a society that is generally closed and untrusting this evolution is most surprising. The evolution has had great political impact.

Russians used social networks to organize the mass protest rallies held before and after Russia's Presidential election. This caught authorities off guard and caused concern. The Government has reacted: they decided to use these same tools and are analyzing the phenomenon of how to best use social networks.

"Social networks do not strengthen the protest mood by themselves. They simply are a coordination tool for the rallies' participants. Virtual social networks substitute for de-facto absence of civil solidarity institutions," a Government official stated.

Russian authorities first voiced their plans to use social networks in April 2011 when the Arab Spring was in full swing. Nothing much happened. It wasn't until the Presidential election that the Government took action. Now, Russian authorities have decided to analyze the influence political news shared on the social networks has on young people. The Kremlin posted on its website a tender order for such a study.

"Internet and social networks influence our life in a growing way

today. We have to be in the front ranks in social networks as we will not achieve anything without them," said the head of the Russian Government's Youth Committee. Reportedly this Committee decided to mount a propaganda campaign by the means of social networks.

"Authorities are not afraid of a revolution realized through social networks, they are simply looking to use this new communication channel to their advantage. Analysis is necessary to understand how to use the tool in order to influence the population," the Agency of Political and Economic Communications stated.

*We do not intend for the following reports to solve any need our readers may have. We do intend to keep everyone current on technology developments in Russia. If you would like any additional information on any of the developments reported – send us a note.*

### New laser diodes from MPI

**Scientists from P.N. Lebedev Moscow Physical Institute (MPI), RAS** are pushing the boundaries of laser diode power. Next generation diodes operating in the 1,060 nm spectral range have been developed. This advance clears the way for increasing power to 20 W and making the product an efficient tool for sectors from metal-cutting to medical surgery and even nuclear energy.

The new diodes show high efficiency, reproducibility of watt-ampere characteristics, and increased reliability. Eleven lasers have undergone lifetime tests at an 8 W output capacity with none of them showing (within the measurement accuracy error) any power loss over a 100 hour period. Some of the diodes produced an output power in excess of 10 W at 10 A pumping current—exceptionally high efficiency for continuous operation mode in the 1,060 nm spectral range. The laser diode service life is now more than 5,000 hours.

Laser diodes can be used as light sources for a wide variety of sophisticated medical instruments used in gynecology, oncology, and other vital areas. The new laser diodes are also expected to make a substantial difference in other sectors, including optical data storage and transmission systems, mechanical engineering, nuclear energy, microbiology, and navigation equipment.

Other technologies are also applied to increase the laser diodes' power and reliability. They are based on artificial diamonds grown by plasma CVD.

#2012-03-222

### Effective lasers for projection television

**Lebedev Moscow Physical Institute, RAS** has completed another step in the development effort to produce effective lasers for projection television. The issue is to develop light sources that are simultaneously powerful and miniature to form trichromatic (RGB)

pixels.

Today light sources mainly used in powerful projection devices are high pressure xenon arc lamps. But these devices' efficiency with xenon lamps is about 1 %.

Scientists have various alternatives for replacing xenon lamps. Several companies tried to use LEDs. However, as their brightness is relatively low, developing projectors with several thousand lumens flux will require using a sophisticated and expensive optical system. Other companies have tried to use lasers. The first commercial laser TV from Mitsubishi (2008) is based on powerful laser diodes that emit in the red and blue spectral regions. For a green radiation source, they used the second solid body laser harmonic with diode-pumped lasers. However these systems are not perfect, one disadvantage is their high cost.

The MPI technology is aimed at developing lasers on semiconductor nanostructures with cathode-ray pumping. The structures contain many thin layers - quantum holes placed at the optical cavity mode antinode. This structure solves the problems associated with operating at high temperature. It also results in a considerable decrease in accelerating voltage and gives longer service life. The structure can be used in RGB sources for small LCD and DMD projectors. But the basic advantage of these sources is their low cost. To date the authors have achieved quite high red laser parameters on the GaInP/AlGaInP nanostructure. Several effective variants for green and blue lasers have been proposed. Special expectations are placed on ZnCdSSe/ZnSSe/GaAs (green light) and ZnSe/ZnMgSSe/GaAs (blue light) structures. Nine Watt laser beam tubes on nanostructures have already been developed in vitro for 640 nm (red light), 3 W for 535 nm (green light) and 6 W for 458 nm (blue light). The red tube development is close to industrial level (efficiency: 10%), it remains only to bring the blue and green tubes up to this level.

#2012-03-223

**Genetically modified plants to combat cadmium in soil**

**Scientists from VNI of Agricultural Microbiology** are using plant-microorganism symbiosis to fight heavy metal soil contamination. The technology utilizes genetically modified plants, which already possess elevated pollutant resistance. The target application is ecosystem restoration in polluted areas.

The conventional methods to remove heavy metals from soil are expensive, generate new waste, reduce soil fertility, and sometimes make it unsuitable for agricultural use. In this connection, plant forms that are resistant to heavy metals and can actively accumulate them are a viable solution to these problems.

Scientists from the Laboratory of Rhizosphere Microorganisms

suggested using plant-microorganism symbiosis for biocenosis regeneration. Here the 'priority' belongs to legumes whose tubercles contain nitrogen-fixing microbes. These microorganisms play an important role in plant growth and nutrition processes. They enhance plant adaptation to adverse environments and protect them from diseases. Many bacteria possess high resistance to heavy metals.

The researchers have bred a plant and bacteria that are resistant to cadmium. To make the plant absorb cadmium more actively, its roots are treated with a complex of these useful bacteria.

The authors use genetically modified plants (peas), which already possess elevated resistance to cadmium. Another "know-how" aspect is using a microorganism mix instead of a single species.

According to researchers, the principal effect from applying this technology goes beyond removing metals. "First, the soil is enriched with nitrogen as peas are legumes. Secondly, the soil is enriched with useful microorganisms that were introduced. Thirdly, the technology gradually restores vegetation in areas that were toxic. In general, this will initiate ecosystem restoration. This restoration is the principal advantage and basic principle for applying the proposed vegetable-bacterial symbiotic systems.

#2012-03-224

### New effects in superconductors

A group of scientists from the **Institute of Solid State Chemistry, RAS (Ural Branch)** identified the processes in complex oxygen-containing superconducting materials that affect their critical temperature. Their findings open the path to developing new materials that could bring about revolutionary changes in many engineering fields.

Laminated iron-based systems are a recently discovered class of substances with high-temperature superconductivity. Study of these superconductors has recently intensified. Scientists hope to find materials that would pass to a superconducting state at quite high temperatures. This would lead to revolutionary changes in many sectors - from computers to space engineering.

A great interest today is complex oxygen-containing materials as a separate class of iron-based compounds. In these structures, layers from iron-nonmetal compounds are separated by oxide layers. A most intriguing feature of these superconducting materials is oxygen non-stoichiometry (i.e., deviation from standard quantitative ratios between chemical components). It is known that structural modification can affect these superconducting materials' critical temperature level. By identifying the laws that govern this dependence, it will be possible to synthesize substances with very high critical temperature values.

The scientists have recently established that the transition temperature for laminated iron-based systems to superconductor state decreases almost twice as the oxygen vacancy number goes down; from 37 K for stoichiometric compositions to 20 K for oxygen-deficient phases.

Using theoretical calculations, the researchers studied the ideal oxygen-deficient system to understand how oxygen vacancies affect the structural and electronic properties.

The calculation results enabled them to conclude that the superconductors' structure and stability depend on the oxygen vacancy position. Thus, if a vacancy is formed in the position known to chemists as 2c, the stoichiometric crystal's initial structure is preserved. On the contrary, if the vacancy is in the position known to chemists as 4f, the original crystalline lattice structure is disturbed. Therefore, as a rule, oxygen vacancies arise in the 2c position, as too many 4f-vacancies will make a superconductor very unstable.

However, the scientists think that the oxygen vacancies presence and position in the superconductor molecule cannot be the only explanation for an appreciable decrease in the critical temperature in the oxygen-deficient systems studied. Decrease in the temperature of transition to a superconducting state can also be caused by changed electron performance. This change is within oxygen-deficient iron-containing multilayer systems. To find an answer to this question, further studies are needed.

#2012-03-225

Optic fibers to operate  
without signal amplifiers

**Novosibirsk scientists** are pushing the limits of fiber optic cable line (FOCL)-based data transmission. In a laboratory at the **Institute of Automation and Electrometry (IAE), RAS (Siberian Branch)**, a new long-distance FOCL system is being developed based on a revolutionary super-long distributed laser. The researchers believe this recent Siberian invention will dramatically reduce current data transmission costs, prevent data or signal attenuation loss, and triple or even quadruple the stable communication span without any additional amplifiers. The innovation which drew upon international scientific collaboration may cause a quantum leap—and a quantum price reduction—in a wide spectrum of telecom technologies from telephony to television and Internet capabilities.

In late 2011 the Institute successfully completed lab tests for its new super-long laser using 300 km long fiber-optic coils. This work resulted in a major headway from what had started out the year before as joint Russian-British research for a fiber laser's possible range limits.

Today's fiber lasers consist of LEDs or laser diodes acting as an excitation module, an active light guide (or optical fiber proper), and

a cavity inside the guide that amplifies a signal.

The Novosibirsk researchers claim their new super-long distributed fiber laser technology eliminates the attenuation problem and renders additional amplifiers redundant by turning an entire FOCL into a resonating cavity that generates signal-amplifying emission.

Other researchers who attempt to reduce the number of signal amplifiers try to push the fiber optics data transmission range by externally applying stimulated scattering of a photon beam. The authors propose a technology where the signal is amplified by generating additional photon beams *inside* the FOCL rather than outside it.

The new beams are evenly distributed along the length of a fiber; therefore the signal doesn't jump or die out but rather intensifies steadily and uniformly to a certain level that offsets prior loss. With such uniformity no extra noise pulses are generated and no data is distorted or lost.

#2012-03-226

**Bryansk Metakley  
Company and its new-  
generation  
nanocomposites**

**Metakley Company** has recently initiated Russia's first production of modified nanosilicates and polymer nanocomposites based on them.

Metakley's priority area is producing modified laminated nanosilicates, masterbatches (superconcentrates to impart desired properties to plastics), and new-generation nanocomposite materials. The nanocomposite materials include high-purity polyfunctional nanocomposites, silane-crosslinked polyolefin compositions and thermoplastic elastomers.

The company offers synthesized materials customized properties. The technology is based on developments by Russia's leading universities, including Moscow State University and Mendeleyev Russian Chemical Technology University.

In its new project, Metakley uses a natural material (montmorillonite) and, using its proprietary technology, modifies the filler to standard sizes – from 10 to 200 nm.

Acting on the end product's ability to crystallize and thus up an additional diffusion barrier, silicate filler nanoparticles enhance the innovative properties of polymer nanocomposites. Among those, according to the developers, are:

- almost zero inflammability,
- elevated heat and fire resistance,
- enhanced shock-proof parameters and durability,
- resistance to cracking and UV radiation,
- high glass transition temperatures,

- low gas and vapor permeability,
- enhanced physico-mechanical characteristics and
- a number of other very useful properties.

Some application areas for the new Metakley products are oil-and-gas industry (coatings for pipes), food processing (modern packaging) and cable making (improved insulation). Other markets are auto makers, which need new solutions to make cars lighter, paint and varnish companies that need coatings with higher weather resistance, and railroads that can use organically modified polymer for improving rail fastenings on tracks.

#2012-03-227

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