SCIENCE NEWS

Where Does All Earth's Gold Come from? Precious Metals the Result of Meteorite Bombardment

During the formation of Earth, molten iron sank to its centre to make the core. This took with it the vast majority of the planet's precious metals — such as gold and platinum. In fact, there are enough precious metals in the core to cover the entire surface of Earth with a four-metre thick layer.

The removal of gold to the core should leave the outer portion of Earth bereft of bling. However, precious metals are tens to thousands of times more abundant in Earth's silicate mantle than anticipated. It has previously been argued that this serendipitous over-abundance results from a cataclysmic meteorite shower that hit Earth after the core formed. The full load of meteorite gold was thus added to the mantle alone and not lost to the deep interior.

To test this theory, Dr Matthias Willbold and Professor Tim Elliott of the Bristol Isotope Group in the School of Earth Sciences analysed rocks from Greenland that are nearly four billion years old, collected by Professor Stephen Moorbath of the University of Oxford. These ancient rocks provide a unique window into the composition of our planet shortly after the formation of the core but before the proposed meteorite bombardment.

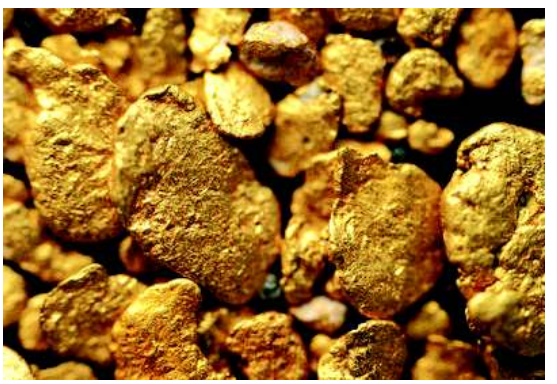
The researchers determined the tungsten isotopic composition of these rocks. Tungsten (W) is a very rare element (one gram of rock contains only about one ten-millionth of a gram of tungsten) and, like gold and other precious elements, it should have entered the core when it formed. Like most elements, tungsten is composed of several isotopes, atoms with the same chemical characteristics but slightly different masses. Isotopes provide robust fingerprints of the origin of material and the addition of meteorites to Earth

would leave a diagnostic mark on its W isotope composition.

Dr Willbold observed a 15 parts per million decrease in the relative abundance of the isotope 182W between the Greenland and modern day rocks. This small but significant change is in excellent agreement with that required to explain the excess of accessible gold on Earth as the fortunate by-product of meteorite bombardment.

Dr Willbold said, "extracting tungsten from the rock samples and analysing its isotopic composition to the precision required was extremely demanding given the small amount of tungsten available in rocks. In fact, we are the first laboratory worldwide that has successfully made such high-quality measurements."

The impacting meteorites were stirred into Earth's mantle by gigantic convection processes. A tantalising target for future work is to study how long this process took. Subsequently, geological processes formed the continents and concentrated the precious metals (and tungsten) in ore deposits which are mined today.



Gold
(Credit: © Martin Kreutz / Fotolia)

Dr Willbold continued, "our work shows that most of the precious metals on which our economies and many key industrial processes are based have been added to our planet by lucky coincidence when the Earth was hit by about 20 billion billion tonnes of asteroidal material."

This research was funded by the Natural Environment Research Council (NERC), the Science and Technology Facilities Council (STFC) and the Deutsche Forschungsgemeinschaft (DFG).

(Source: Science Daily Online)

New Material: Possible Boon for Lithium Ion Batteries

A team led by Hansan Liu, Gilbert Brown and Parans Paranthaman of the Department of Energy Lab's Chemical Sciences Division found that titanium dioxide creates a highly desirable material that increases surface area and features a fast charge-discharge capability for lithium ion batteries. Compared to conventional technologies, the differences in charge time and capacity are striking.

"We can charge our battery to 50 per cent of full capacity in six minutes while the traditional graphite-based lithium ion battery would be just 10 per cent charged at the same current," Liu said.

Compared to commercial lithium titanate material, the ORNL compound also boasts a higher capacity — 256 versus 165 milliampere hour per gram — and a sloping discharge voltage that is good for controlling state of charge. This characteristic combined with the fact oxide materials are extremely safe and long-lasting alternatives to commercial graphite make it

well-suited for hybrid electric vehicles and other high-power applications.

The results, recently published in *Advanced Materials*, could also have special significance for applications in stationary energy storage systems for solar and wind power, and for smart grids. The titanium dioxide with a bronze polymorph also has the advantage of being potentially inexpensive, according to Liu.

At the heart of the breakthrough is the novel architecture of titanium dioxide, named mesoporous TiO_2-B microspheres, which features channels and pores that allow for unimpeded flow of ions with a capacitor-like mechanism. Consequently, a lithium ion battery that substitutes TiO_2-B for the graphite electrode charges and discharges quickly.

"Theoretical studies have uncovered that this pseudocapacitive behaviour originates from the unique sites and energetics of lithium absorption and diffusion in TiO_2-B structure," the authors write in their paper.

Paranthaman noted that the microsphere shape of the material allows for traditional electrode fabrication and creates compact electrode layers. He also observed, however, that the production process of this material is complex and involves many steps, so more research remains to determine whether it is scalable.

Other authors of the paper are Zhonghe Bi, Xiao-Guang Sun, Raymond Unocic and Sheng Dai. The research was supported by DOE's Office of Science, ORNL's Laboratory Directed Research and Development programme and ORNL's (Shared Research Equipment) SHaRE User Facility, which is sponsored by Basic Energy Scmiences.

(Source: Science Daily Online)

Potatoes Reduce Blood Pressure in People with Obesity and High Blood Pressure

But don't reach for the catsup (ketchup), vinegar or mayonnaise. The research was not done with French fries, America's favourite potato, but with potatoes cooked without oil in a microwave oven. Although researchers used purple potatoes. They believe that red-skin potatoes and white potatoes may have similar effects.

"The potato, more than perhaps any other vegetable, has an undeserved bad reputation that has led many health-conscious people to ban them from their diet," said Joe Vinson, Ph.D., who headed the research. "Mention potato and people think 'fattening, high-carbs, empty calories'. In reality, when prepared without frying and served without butter, margarine or sour cream, one potato has only 110 calories and dozens of healthful phytochemicals and vitamins. We hope our research helps to remake the potato's popular nutritional image."

In the new study, 18 patients who were primarily overweight/obese with high blood pressure ate 6-8 purple potatoes (each about the size of a golf ball) with skins twice daily for a month. They used purple potatoes because the pigment, or colouring material, in fruits and vegetables is especially rich in beneficial phytochemicals. Scientists monitored the patients' blood pressure, both systolic (the higher number in a blood pressure reading like 120/80) and diastolic. The average diastolic blood pressure dropped by 4.3 per cent and the systolic pressure decreased by 3.5 per cent, said Vinson, who is with the

University of Scranton in Pennsylvania and has done extensive research on healthful components in foods. The majority of subjects took anti-hypertensive drugs and still had a reduction in blood pressure. None of the study participants gained weight.

Vinson said that other studies have identified substances in potatoes with effects in the body similar to those of the well-known ACE-inhibitor medications, a mainstay for treating high blood pressure. Other phytochemicals in potatoes occur in amounts that rival broccoli, spinach and Brussels sprouts, and also may be involved, Vinson added.

The potato's stereotype as a fattening food for health-conscious folks to avoid is getting another revision as scientists report that just a couple servings of spuds a day reduces blood pressure almost as much as oatmeal without causing weight gain.
(Credit: © JMB / Fotolia)

Unfortunately for French fry and potato chip fans, those high cooking temperatures seem to destroy most of the healthy substances in a potato, leaving mainly starch, fat and minerals. Potatoes in the study were simply microwaved, which Vinson said seems to be the best way to preserve nutrients.

The purple potatoes used in the study are becoming more widely available in supermarkets and especially in food stores and farmers' markets. Vinson said that he strongly suspects a future study using white potatoes, now in the planning stages, will produce similar results. Funding for the study came from the United States Department of Agriculture-Agricultural Research Service (USDA-ARS) State Cooperative Potato Research Program.

(Source: Science Daily Online)

Mathematics will Increase Aluminium Recycling

The objective of the five-year project is to develop technical production 'recipes' which will enable aluminium scrap to re-emerge in the form of high quality consumer products — everything from foil to window frames.

"The results are promising," says Yanjun Li, a project manager at SINTEF.

Accumulation of impurities

The recycling of aluminium requires only five per cent of the energy used in producing new aluminium. This means a potential 95 per cent reduction in greenhouse gases in connection with production.

However, every time aluminum is recycled, various alloy constituents such as iron, silicon and zinc, as well as trace elements such as sodium and lead, accumulate in the resulting material.

Until now this has placed clear limitations on what recycled aluminium can be used for, even when a high proportion of pure aluminium is added to dilute the concentration of undesirable elements. However, these limitations are now to be eased.

Casting is the Past

Recycled aluminium has so far mainly been used in cast products, which may be anything from car wheel rims to engine blocks.

However, in just a few years' time of the casting market will probably be too small to absorb the rapidly increasing amount of recycled aluminium which will enter the material stream.

Rolling and Extrusion are the Future

If the world is to benefit from the increased availability of recycled aluminium, new routes must be opened to the market for such materials.

Put simply, this means that rolling and extruding plants must be adapted to accept far higher proportions of recycled material.

These are factories designed for aluminium-based mass production.

Sheets and Mouldings

Rolling produces aluminium material in the form of sheets, foil and strips.

Aluminium which has been put through an extrusion plant ends up as mouldings or profiles. These can be found in the light fitting above your head, in the front panel of your radio, in the window frames of quality buildings or as heat exchangers in car radiators — to mention just a few examples.

Specialist Project

The desire to make recycled aluminium a raw material for rolling and extrusion mills is the background for the specialist project, MOREAL (2009-2013).

SINTEF and NTNU are running the project in collaboration with Hydro Aluminium and the Swedish company Sapa Technology, with partial financing from the Research Council of Norway.

Focus on Tempering Process

"The impurities which accumulate in aluminium through repeated recycling affect the mechanical properties of the recycled material. However, by changing the alloy composition and temperature conditions, and the speed of the homogenisation process — the initial stage in a tempering process carried out in rolling and extrusion plants — it is possible to compensate for this," says Yanjun Li.

According to the research scientist, by effecting such changes it will be entirely possible to make use of recycled aluminium in rolled products and aluminium mouldings which satisfy any required mechanical properties, such as strength and malleability.

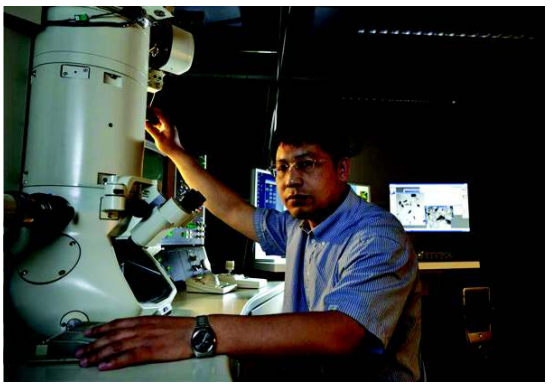
The PC as a Test Lab

The SINTEF employee explains that it is both expensive and time-consuming to determine the right process changes by trial and error in physical experiments in the factories. Instead, the researchers prefer to use mathematical models — in other words, tools which describe real conditions by means of mathematical formulae.

"In the MOREAL project, we are developing advanced mathematical models as a supplement

to laboratory experiments. These are powerful tools which make the development of recycling-friendly aluminium alloys cheaper and less time-consuming," says Yanjun Li.

The project will lead to three different models, all of which will show how the microstructure of recycled materials is affected by various modifications in homogenisation during the extrusion and rolling processes.



Research Scientist Yanjun Li studies the microstructure of aluminium alloys using an electron microscope.
(Credit: SINTEF / Thor Nielsen)

Promising Results

"Using mathematical modelling as a guide, we have carried out physical laboratory experiments with an aluminium alloy in the so-called '3xxx family.' This is a commonly used alloy group in which manganese is an additive, providing good malleability, increased tensile strength and high corrosion resistance. We demonstrated that the yield point of the alloy, we investigated can be increased by 50 per cent by modifying the homogenisation process. In plain language, this means that the material will tolerate far more bending before it breaks," says Li.

In 2009, around one-fifth of the world's aluminium production originated from recycled materials. Most of the recycled raw material comes from the transport sector and packaging products, but in recent years aluminium from the construction industry has been increasingly recycled.

"The aim of our project is to enable our industrial partners to produce more tailored, recycling friendly aluminium alloys. Expertise in this field will be increasingly important for sustainability and global competitiveness in the materials industry," says Yanjun Li.

(Source: Science Daily Online)

Zero-Gravity Experiments

Dr Niel Crews, assistant professor of mechanical engineering, and Collin Tranter, a graduate student with the Institute for Micromanufacturing (IfM) say the instrument could be used to monitor the health of astronauts exposed to cosmic radiation beyond Earth's protective atmosphere.

"Our goal is to understand how the system behaves under conditions similar to actual deployment in space missions," said Crews. The Louisiana Tech-developed devices are beneficial to NASA because they are small, consume less power and require little to no human operation.

The Louisiana Tech researchers will subject themselves to extreme conditions in order to conduct sensitive testing of the miniature device. NASA has used these same flights to train their astronauts.

The instrument attracted the attention of NASA scientists for possible use on the International

Space Station, during inter-planetary travel and even for unmanned missions to search for life within the Solar System.

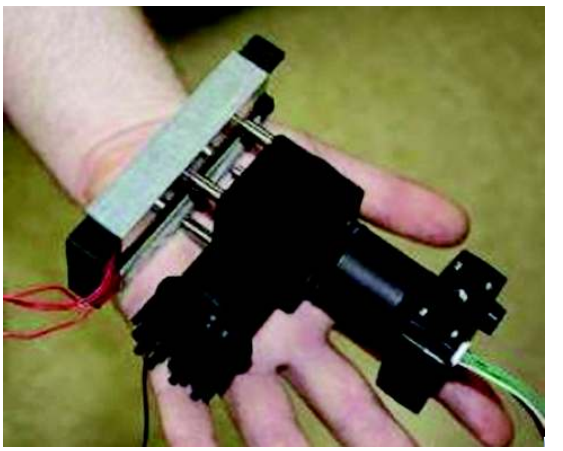
"We hope that by working with NASA, one of our DNA analysis devices will be sent into orbit to study the effects of space environments on living things, first studying DNA then cells," said Tranter. "Some further testing has to occur first, such as making sure the device works properly in low-gravity conditions. This will be done on a parabolic aircraft flight hopefully before the end of the year."

The tests will take place on a NASA airplane operating out of Ellington Field at Johnson Space Centre in Houston. The flight pattern will consist of forty steep dives and climbs over the Gulf of Mexico. A controlled dive of nearly 10,000 feet in less than one minute will result in approximately 20 seconds of weightlessness for the researchers and the payload onboard. An abrupt climb back to the starting altitude will create a gravitational force twice the normal amount.

Even Hollywood has gotten into the act, using these flights to depict weightlessness on the silver screen. All of the zero-gravity scenes in the movie Apollo 13 were filmed during these flights. The alternation between zero-gravity and 2G forces can so disorienting that NASA astronauts call the aircraft the "vomit comet."

NASA recently selected this system for a week-long series of flights as part of their Facilitated Access to the Space Environment for Technology (FAST) programming, which focuses on expanding new technologies to be used in space flight applications.

Tranter is pursuing a Ph.D. in Nanosystems Engineering at Louisiana Tech and will continue to work with Crews on the project. He says they hope to learn very soon if their device can stand up to space environments.



DNA analyser developed at Louisiana Tech University. (Credit: Image courtesy of Louisiana Tech University)

"Low gravity can cause all kinds of unpredictable problems," Tranter said. "Eventually, I hope our system can reveal more about space radiation effects on DNA and cells, leading to options for safe space travel and exploration by humans. Our lab has studied some effects of radiation on DNA, such as UV exposure, but nothing on Earth compares to the environments we hope to study outside of the Earth's atmosphere."

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by Louisiana Tech University. The original article was written by Catherine Fraser.

(Source: Science Daily Online)

Microscope on the Go: Cheap, Portable, Dual-Mode Microscope Uses Holograms, not Lenses

Their prototype weighs about as much as a medium-sized banana and fits in the palm of a hand. And, since it relies in part on mass-produced consumer electronics, all the materials to make it add up to between $50 and $100 USD.

It also has a two-in-one feature: a transmission mode that can be used to probe relatively large volumes of blood or water, and a reflection mode that can image denser, opaque samples. The spatial resolution for both modes is less than two micrometers — comparable to that achieved by bulkier microscopes with low- to-medium power lenses.

"This is the first demonstration of essentially a hand-held version of a microscope that can do dual-mode imaging within a very compact and cost-effective form," says Aydogan Ozcan, an associate professor of electrical engineering and bioengineering at UCLA and senior author of the paper.

"With just a small amount of training, doctors could use devices like these to improve health care in remote areas of the world with little access to diagnostic equipment," Ozcan says. The handheld microscope could help ensure water quality, test patients' blood for harmful bacteria, and even be used for semen-quality monitoring on animal farms.

It could also prove useful in health crises such as the recent outbreak of E. coli in Europe.

"It's a very challenging task to detect E. coli in low concentrations in water and food," Ozcan says. "This microscope could be part of a solution for field investigation of water, or food, or may be pathogens in blood."

Part of the device's success is the weight it shed when researchers got rid of the bulkier, heavier, more expensive pieces that most microscopes rely on for collecting and focusing light: the lenses. Instead of lenses, this microscope uses holograms.

Holograms are formed when light bouncing off (or passing through) a three-dimensional object is made to interfere with a 'reference beam,' or light that has not hit the object. Consider this analogy: drop a stone into a still pond and the ripples will move outward in a circle. Drop two stones and the circular ripples will interfere with each other, making a new pattern of crests and troughs. A person (or computer) analysing the interference pattern created by those two stones could trace the source back to the stones and recreate what had happened to make the waves.

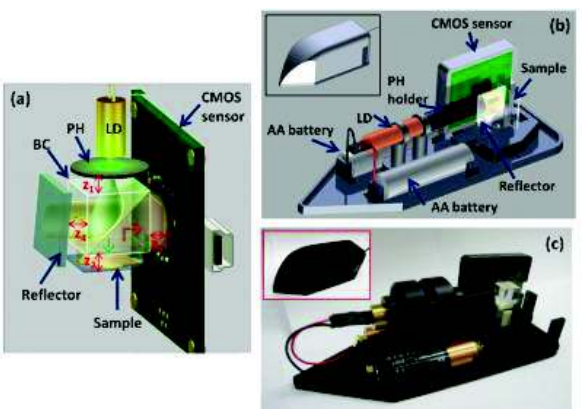
The UCLA team's device uses a similar principle to recreate images from interfering light waves.

An inexpensive light source is divided into two beams — one that interacts with microscopic cells or particles in the sample, and the other that does not. The beams then pass to an adjacent sensor chip, where their interference pattern is recorded.

Software then analyses that pattern and recreates the path taken by the light that passed through or bounced off of the objects being imaged.

"Each component of the device is fairly inexpensive," Ozcan says. The laser light could come from a $5 laser pointer. The sensor chip that collects that light is the same as the ones in the backs of iPhones and Blackberrys and costs less than $15 per chip. And the whole image-collecting system runs on two AA batteries.

Where the researchers have reduced weight and expense in doing away with lenses, they have added the power of the cloud. The microscope captures raw data; but a computer is required to reconstruct the images. Workers in the field could use their laptops to process the information or send it over the Internet or mobile phone networks to a remote server. Mobile phones could also have sufficient processing power to do the analysis on the spot.



In reflection mode, the holographic microscope can create images of dense, opaque materials, such as water filters: (a-b) Laser light from a laser diode ("LD" in the diagrams) is projected through a pin hole ("PH") and then split into two beams by a beam cube (labeled "BC"). One beam of light hits the sample; the other does not. The beams are then reunited to form an interference pattern, which is recorded on a CMOS image sensor. (c) This photograph shows the microscope in reflection mode, with its cover removed. (The inset shows what the microscope looks like with its cover on.) The device weighs about 200 grams and is 15 cm long, 5.5 cm high, and 5 cm wide. (Credit: Ozcan BioPhotonics Group at UCLA/ Biomedical Optics Express.)

Essentially, Ozcan says, "we are replacing an expensive and bulky, heavy component with computer codes."

The next steps for Ozcan's team include commercialising the device. Ozcan says he has founded a company that is developing this technology, trying to make a version of the microscopes that can be manufactured and sold to healthcare workers and hobbyists.

"Global health is a big field that requires better diagnostic tools, because resource-poor countries don't have the infrastructure for conducting essentially accurate diagnostic tests," Ozcan says. "There are so many problems that innovative solutions [like this microscope] would impact."

(Source: Science Daily Online)

New Device Helps the Blind to Move Independently

EYE 21 is an electronic tool that allows blind people to move autonomously in any environment. The blind, thanks to a pair of sunglasses equipped with two micro cameras and headphones, are able to perceive an acoustic image of the space at which they point their *new eyes*. This tool has been developed as a continuation of the European project Casblip.

In its first version, the system recognises shapes and replaces them with sounds positioned on the surface of the recognised

forms. The two micro cameras analyse space, create a three-dimensional model of it and associate sound points to point on the surface that is being analysed. In this way, a blind person *can hear space*, and their brain reconstructs its shape from that spatialised sound.

"We all have a natural ability to talk at the same time as we detect the position of coin that has just hit the ground. This ability to represent space with sounds without disturbing other activities of the brain is the basis of how this system works. Combining object recognition technology with sound representation of space allows a blind person to recreate those sounds and perceive their original shape," said Guillermo Peris.

Testing the new system
(Credit: Image Courtesy of Asociación RUVID)

According to this researcher from the Universitat Politècnica de València's CITG, with this system, users will have a new sense of perception of 3D space, different from sight: "We still do not know its limitations, but we do know many of its possibilities." At the moment, there are four prototypes of it and ten new ones are intended to be put into operation in the coming weeks.

"This step forward, which is the fruit of several years' work and of several research projects, is a further help for blind people to integrate into society and improve their quality of life," adds Peris.

The above story is reprinted (with editorial adaptations by Science *Daily* staff) from materials provided by Asociación RUVID, via AlphaGalileo.

(Source: Science Daily Online)

Hand-Held Unit to Detect Cancer in Poorer Countries

Syed Hashsham, a professor of civil and environmental engineering at MSU, is developing the Gene-Z device, which is operated using an iPod Touch or Android-based tablet and performs genetic analysis on microRNAs and other genetic markers. MicroRNAs are single-stranded molecules that regulate genes; changes in certain microRNAs have been linked to cancer and other health-related issues.

He is working with Reza Nassiri, director of MSU's Institute of International Health and an assistant dean in the College of Osteopathic Medicine, on the medical capabilities for the device and establishing connections with physicians worldwide.

"Cancer is emerging as a leading cause of death in underdeveloped and developing countries where resources for cancer screening are almost non-existent," Nassiri said.

"Until now, little effort has been concentrated on moving cancer detection to global health settings in resource-poor countries," he said. "Early cancer detection in these countries may lead to affordable management of cancers with the aid of new screening and diagnostic technologies that can overcome global health care disparities."

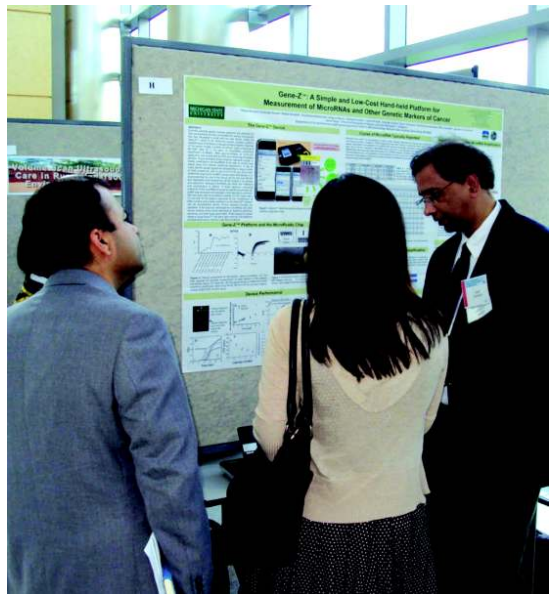
Hashsham demonstrated the potential of the Gene-Z at the National Institutes of Health's first Cancer Detection and Diagnostics Conference. The conference, held recently in Bethesda, Md., was sponsored by the Fogarty International Center and the National Cancer Institute.

"Gene-Z has the capability to screen for established markers of cancer at extremely low costs in the field," Hashsham said. "Because it is a hand-held device operated by a battery and chargeable by solar energy, it is extremely useful in limited-resource settings."

The NIH conference was attended by several U.S. research institutions, including MSU. One of the primary objectives of the meeting was to address the utility of new cancer detection technologies.

Since cancer diagnostics and rapid screening methods currently are not suitable for low-income and resource-limited countries, Nassiri said a concentrated effort should be made to develop more appropriate and cost-effective technologies such as the one developed by Hashsham for widespread global use.

Nassiri said the goal is to continue the partnership between Hashsham and MSU's Institute of International Health to promote his Gene-Z device globally and validate it in the field with clinical care partners across the world.



MSU engineering professor Syed Hashsham (right) talks with conference delegates about his diagnostic development project Gene-Z, which has the potential to offer low-cost cancer detection technology to resource-poor countries.
(Credit: Image courtesy of Michigan State University)

In addition to cancer detection, the Gene-Z device also is being developed to diagnose routine tuberculosis and drug-resistant TB, determine HIV virus levels during treatment and monitor overall antibiotic resistance.

Working with Hashsham in the development of the Gene-Z device was a team of MSU students, led by Robert Stedtfeld including Farhan Ahmad, Dieter Tourlousse and Greg Seyrig. The cancer marker approach was led by Maggie Kronlein, a civil and environmental engineering undergraduate researcher.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by Michigan State University.

(Source: Science Daily Online)

World-Record Pulsed Magnetic Field Achieved; Lab Moves Closer to 100-Tesla Mark

The scientists achieved a field of 92.5 tesla on Thursday, August 18, taking back a record that had been held by a team of German scientists and then, the following day, surpassed their achievement with a whopping 97.4 tesla field. For perspective, Earth's magnetic field is 0.0004 tesla, while a junk-yard magnet is 1 tesla and a medical MRI scan has a magnetic field of 3 tesla.

The ability to create pulses of extremely high magnetic fields non-destructively (high-power magnets routinely rip themselves to pieces due to the large forces involved) provides researchers with an unprecedented tool for studying fundamental properties of materials, from metals and superconductors to semi-conductors and insulators. The interaction of high magnetic fields with electrons within these materials provides valuable clues for scientists about the properties of materials. With the recent record-breaking achievement, the Pulsed Field Facility at LANL, a national user facility, will routinely provide scientists with magnetic pulses of 95 tesla, enticing the worldwide user community to Los Alamos for a chance to use this one-of-a-kind capability.

The record puts the Los Alamos team within reach of delivering a magnet capable of achieving 100 tesla, a goal long sought by researchers from around the world, including scientists working at competing magnet labs in Germany, China, France and Japan.

Such a powerful non-destructive magnet could have a profound impact on a wide range of scientific investigations, from how to design and control material functionality to research into the microscopic behaviour of phase transitions. This type of magnet allows researchers to carefully tune material parameters while perfectly reproducing the non-invasive magnetic field. Such high magnetic fields confine electrons to nanometer scale orbits, thereby helping to reveal the fundamental quantum nature of a material.

Thursday's experiment was met with as much excitement as trepidation by the group of condensed matter scientists, high-field magnet technicians, technologists, and pulsed magnet engineers who gathered to witness the NHMFL-PFF retake the world record. Crammed into the tight confines of the Magnet Lab's control room, they gathered lab notebooks or caffeine of choice in hand. Their conversation reflected a giddy sense of anticipation tempered with nervousness.

With Mike Gordon commanding the controls that draw power off of a massive 1.4 gigawatt generator system and directs it to the magnet, all eyes and ears were keyed to video monitors showing the massive 100 tesla Multishot Magnet and the capacitor bank located in the now eerily empty Large Magnet Hall next door. The building had been emptied as a standard safety protocol.

Scientists heard a low warping hum, followed by a spine-tingling metallic screech signaling that the magnet was spiking with a precisely distributed electric current of more than 100 megajoules of energy. As the sound dissipated and the monitors

confirmed that the magnet performed perfectly, attention turned to data acquired during the shot through two *in situ* measurements — proof positive that the magnet had achieved 92.5 tesla, thus yanking back from a team of German scientists a record that Los Alamos had previously held for five years.

Yates Coulter (left) and Mike Gordon of Los Alamos National Laboratory make final preparations before successfully achieving a world-record for the strongest magnetic field produced by a non-destructive magnet. Working at the National High Magnetic Field Laboratory's Pulsed Field Facility at Los Alamos, a team of researchers achieved a field of 97.4 tesla, which is nearly 100 times stronger than the magnetic field found in giant electromagnets used in metal scrap yards.
(Credit: Image Courtesy of DOE/Los Alamos National Laboratory)

The next day's even higher 97.4 tesla achievement was met with high-fives and congratulatory pats on the back. Later, researchers Charles Mielke, Neil Harrison, Susan Seestrom and Albert Migliori certified with their signatures the data that would be sent to the Guiness Book of World Records.

The NHMFL is sponsored primarily by the National Science Foundation, Division of Materials Research, with additional support from the State of Florida and the DOE. These recent successes were enabled by long-term support from the U.S. Department of Energy's Office of Basic Energy Sciences and the National Science Foundation's 100 Tesla Multi-Shot magnet programme

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by DOE/Los Alamos National Laboratory.

(Source: Science Daily Online)

TV Time: Why Children Watch Multi-Screens

A sedentary lifestyle, linked to spending lots of time watching TV and playing computer games, is thought to lead to obesity, lower mental well-being, and cause health problems in later life, including diabetes. It is now possible to watch TV 'on demand' via the internet, play computer games on laptops, on hand-held devices or mobile phones, to keep in contact with friends using text, Facebook, Skype, and MSN, and to do all this concurrently. However previous studies have not examined if children take part in multi-screen viewing or children's reasons for doing so.

Questioning 10–11 year olds, researchers at the University of Bristol and Loughborough University found that the children enjoyed looking at more than one screen at a time. They used a second device to fill in breaks during their entertainment, often talking or texting their friends during adverts or while they were waiting for computer

games to load. TV was also used to provide background entertainment while they were doing something else — especially if the programme chosen by their family was 'boring'.

Dr Jago from the University of Bristol explained, "Health campaigns recommend reducing the amount of time children spend watching TV. However the children in this study often had access to at least five different devices at any one time, and many of these devices were portable. This meant that children were able to move the equipment between their bedrooms and family rooms, depending on whether they wanted privacy or company. So simply removing the TV from a child's room may not be enough to address the health concerns and we need to work with families to develop strategies to limit the overall time spent multi-screen viewing wherever it occurs within the home."

(Source: Science Daily Online)

School Children can also Learn Complex Subject Matters on their Own

Calculating the surface area of Gran Canaria is not an easy task for a 14-year-old child. It's not simply a question of learning the right formula. Students have to develop a strategy that enables them to put mathematical theory into practice — working out the information that is important and applying the right geometric models and tools. Realising that the island has an almost circular shape and so its surface area can be approximated using the area of a circle is not as straightforward as it sounds. Are schoolchildren capable of developing these kinds of solutions themselves or should teachers explain the strategies before asking the pupils to tackle the problems?

To find the answer, researchers in mathematics education from TUM worked with approximately 1600 eighth grade high-school (Gymnasium) students in various German states. Following an introduction on the general topic by their teachers, the school children were given a workbook of geometric tasks that they had to solve on paper and using a computer over four school periods. Calculating the surface area of Gran Canaria was just one of the real-world, free-form assignments the students had to tackle. The workbook material included explanations and examples of various problem-solving approaches. The teachers took a back seat during the session but were on hand to answer questions from the children, who worked in pairs.

After testing the students' skills before and after the session, the TUM researchers recorded a significant improvement in their capabilities. "They learnt to apply mathematics more effectively," explains study leader Professor Kristina Reiss. The students were also able to call on these skills in a further test three months later.

The researchers also wanted to find out what degree of child direction is most effective. One group, therefore, worked on the tasks in a fixed ascending order of difficulty. The other group was free to choose from the assignments provided. This greater degree of freedom did not enhance the learning experience, however. Another discovery came as an even bigger surprise to the researchers: "We expected students who were weaker at math to benefit more from a greater

degree of guidance through the module," reports Reiss. "But we didn't see a significant difference between these and stronger students." There were also no differences between boys and girls. "We now know that students — also those who are weaker in math — have the skills to master even very complex subject matters at their own pace," continues Reiss. "Although extended phases of self-directed learning are often advocated, they are still not part of the everyday school curriculum. But they are an important option for teachers as varied lesson formats ensure a lively and interesting learning experience."

The trial was financed by Germany's Federal Ministry of Education and Research and was supported by psychologists from the Ludwig-Maximilians-Universität München (Prof. Reinhard Pekrun).

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(Source: Science Daily Online)

Social Networking's Good and Bad Impacts On Kids

"While nobody can deny that Facebook has altered the landscape of social interaction, particularly among young people, we are just now starting to see solid psychological research demonstrating both the positives and the negatives," said Larry D. Rosen, Ph.D., professor of psychology at California State University, Dominguez Hills.

In a plenary talk entitled, "Poke Me: How Social Networks can Both Help and Harm Our Kids," Rosen discussed potential adverse effects, including:

- Teens who use Facebook more often show more narcissistic tendencies while young adults who have a strong Facebook presence show more signs of other psychological disorders, including antisocial behaviours, mania and aggressive tendencies.
- Daily overuse of media and technology has a negative effect on the health of all children, pre-teens and teenagers by making them more prone to anxiety, depression, and other psychological disorders, as well as by making them more susceptible to future health problems.
- Facebook can be distracting and can negatively impact learning. Studies found that middle school, high school and college students who checked Facebook at least once during a 15-minute study period achieved lower grades.

Rosen said new research has also found positive influences linked to social networking, including:

- Young adults who spend more time on Facebook are better at showing 'virtual empathy' to their online friends.
- Online social networking can help introverted adolescents learn how to socialise behind the safety of various screens, ranging from a two-inch smartphone to a 17-inch laptop.
- Social networking can provide tools for teaching in compelling ways that engage young students.

For parents, Rosen offered guidance. "If you feel that you have to use some sort of computer

programme to surreptitiously monitor your child's social networking, you are wasting your time. Your child will find a workaround in a matter of minutes," he said. "You have to start talking about appropriate technology use early and often and build trust, so that when there is a problem, whether it is being bullied or seeing a disturbing image, your child will talk to you about it."

He encouraged parents to assess their child's activities on social networking sites and discuss removing inappropriate content or connections to people who appear problematic. Parents also need to pay attention to the online trends and the latest technologies, websites and applications children are using, he said.

"Communication is the crux of parenting. You need to talk to your kids, or rather, listen to them," Rosen said. "The ratio of parent listen to parent talk should be at least five-to-one. Talk one minute and listen for five."

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