NEW TEAM, NEW IDEAS

In July 2020, three new Vice Presidents took office at the Max Planck Society. Asifa Akhtar, Director of the Max Planck Institute of Immunobiology and Epigenetics in Freiburg, is the first female Vice President of the Biology and Medicine Section. Born in Pakistan, Akhtar wants to advance internationalization at the Max Planck Society and is the contact person for the Max Planck Schools. Equality and diversity are also important to her. The Vice President of the Humanities, Social and Human Sciences Section is Ulman Lindenberger, Director of the Max Planck Institute for Human Development in Berlin. In this position, he will take over the scientific management of the Minerva Foundation for the Promotion of Scientific Cooperation with Israel. Lindenberger is also keen to provide new stimuli for the appointment procedure at the Max Planck Society. Klaus Blaum, Director of the Max Planck Institute for Nuclear Physics in Heidelberg, is the Vice President of the Chemistry, Physics and Technology Section. He is responsible for technology transfer and Cyber Valley, but the issue of sustainability is also close to his heart. Blaum also aims to improve the exchange with the Chinese Academy of Sciences. Nicola Leibinger-Kammüller, Chairperson of the Management Board of Trumpf, took office as an external member of the Executive Committee.

www.mpg.de/15105526

PHOTOS: MARCUS ROCKOFF, DAVID AUSSERHOFER, STEFANIE AUMILLER (FROM LEFT TO RIGHT)

The new team supporting Max Planck President Martin Stratmann: Asifa Akhtar, Ulman Lindenberger and Klaus Blaum (from left).

IDENTIFYING VICTIMS

During the Nazi era, the predecessors of several Max Planck Institutes used the remains of victims of the Nazi regime for their research. After the end of World War II, the Institutes kept and in some cases even used these specimens, most of which were sections of brain tissue, until the Max Planck Society had them interred in 1990. In 2015 and 2016, still more specimens were discovered at the Max Planck Institutes of Psychiatry and Brain Research. Max Planck President Martin Stratmann responded to these findings by having an external expert committee investigate the identity and origins of all the victims whose remains had been found. In the spring of 2020, the commission presented its initial results in the form of an interim report: they had succeeded in finding out the names of the victims in more than one thousand cases. Some of them had lived at the mental institution in Eglfing-Haar, near Munich. The Nazis had murdered them because of their physical or mental disabilities. Other victims came from the occupied Polish territories, were prisoners of war, or were executed by the Nazi Volksjustiz (the so-called People's Justice).

www.mpg.de/14472738

IN BRIEF

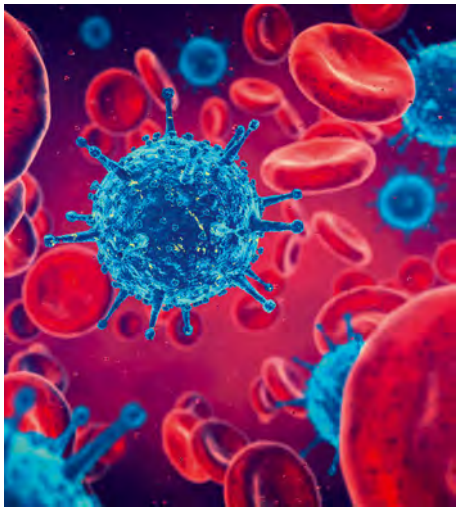


IMAGE: NOBEASTSOFIERCE/ADOBE STOCK

Attack on the immune system: one way in which HIV viruses are transmitted is in the blood.

GENE SCISSORS AGAINST HIV

It could be the first treatment to permanently eliminate the HIV virus from the body – the medications currently available are only able to keep it at bay. A team from the Heinrich Pette Institute – Leibniz Institute for Experimental Virology (HPI) in Hamburg and the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden has developed 'gene scissors' using an enzyme known as Brec1, which can cut the genetic material of the AIDS pathogen out of the genome of infected cells and thus remove the virus. The Hamburg-based biotech startup Provirex has developed this technology further so that it is now ready for use in the form of stem cell treatment. The HPI and the Medical Center Hamburg-Eppendorf are now preparing for clinical trials in which the treatment will be administered to eight patients.

www.mpg.de/14744748

AWARD-WINNING ★

VOLKER SPRINGEL

Volker Springel, Director of the Max Planck Institute for Astrophysics in Garching, has been awarded the 2020 Gruber Cosmology Prize for his valuable contribution to simulations of the universe. Springel will share the US$500,000 prize money with Lars Hernquist from the Harvard-Smithsonian Center for Astrophysics. The two researchers have developed methods for testing theories about the formation of structures in the universe on scales that encompass stars, galaxies, and even the universe itself. To this end, they developed numerical algorithms and community codes that many other researchers are now also using.

PHOTO: HEIDELBERG INSTITUTE FOR THEORETICAL STUDIES (HITS)

FRIEDRICH BONHOEFFER

Friedrich Bonhoeffer, Emeritus Director of the Max Planck Institute for Developmental Biology in Tuebingen, has been awarded the 2020 Gruber Neuroscience Prize. Bonhoeffer shares the prize with Corey Goodman from the University of California in San Francisco and Marc Tessier-Lavigne from Stanford University for their joint research into molecular mechanisms in the central nervous system. The discoveries made by these three researchers have fundamentally changed our understanding of the formation of neural networks in the brain and have led to insights into neurological and psychiatric diseases and how the nervous system recovers after injury.

PHOTO: BERTHOLD STEINHILBER

PHOTO-SYNTHESIS IN A DROPLET

Plants have been able to do it for millions of years, now humans may soon be able to do it too: photosynthesis, i.e. the harnessing of solar energy to convert carbon dioxide into usable carbon compounds. Researchers at the Institute for Terrestrial Microbiology in Marburg, working as part of the interdisciplinary research network MaxSynBio, have now developed minute compartments in which solar energy is converted into chemical energy, not unlike the process that takes place in natural chloroplasts in plants. To do this, they started by isolating the chloroplast membranes of spinach plants; the photosynthesis apparatus found on these membranes, which converts light energy into chemical energy, was then coupled with a metabolic module developed by the scientists themselves. This CETCh cycle, which consists of 18 enzymes, uses the energy to build carbohydrates from carbon dioxide in a way which is more efficient than natural photosynthesis. Working in cooperation with colleagues in France, the Max Planck scientists have developed a method with which they can encapsulate the metabolic pathway within tiny droplets. This enables them to produce thousands of standardized compartments or assign various attributes to individual droplets. The artificial chloroplasts can already fix carbon dioxide 100 times faster than previous systems. Another advantage is that these chloroplasts contain only the components that are absolutely necessary for photosynthesis. At the same time, they are not dependent on natural enzymes. In future, researchers will therefore be able to use the new artificial chloroplasts to test reaction pathways that do not occur in nature. Lifelike systems of this kind could be used to produce almost any kind of material in many technological areas, such as material science, biotechnology and medicine. They could also facilitate the use of ambient carbon dioxide, thus making it possible to exploit the greenhouse gas as a source of raw material in the future.

www.mpg.de/14788928

IMAGE: TOBIAS ERB/MPI FOR TERRESTRIAL MICROBIOLOGY

Semi-synthetic chloroplasts: the 0.1 millimeter droplets contain the membranes of natural chloroplasts. In conjunction with an artificial metabolic cycle, they can use solar energy to fix carbon dioxide.

GRAPHIC: GCO

THE ANXIETY OVER TOILET PAPER

The rapid spread of COVID-19 throughout Europe and North America in March 2020 caused many people to stockpile large quantities of certain commodities. Some toilet paper manufacturers, for example, saw their sales rise by up to 700 percent. In a study of more than one thousand adults from 35 countries conducted at the end of March 2020, researchers at the Max Planck Institute for Evolutionary Anthropology in Leipzig investigated possible connections between personality traits and the purchase of these hygiene articles. They also analyzed the age, perceived level of threat, and quarantine behavior of the participants. The results showed that anxious people who felt more threatened by the pandemic stockpiled more toilet paper. Personality traits such as conscientiousness, perfectionism and cautiousness also affected their purchasing behavior. Moreover, it was found that older people stockpiled more toilet paper than younger people and Americans stockpiled more than Europeans. However, the results obtained by the scientists only partly explain the discrepancies in purchasing behavior. This means there must still be undetermined factors that explain this anxiety over toilet paper.

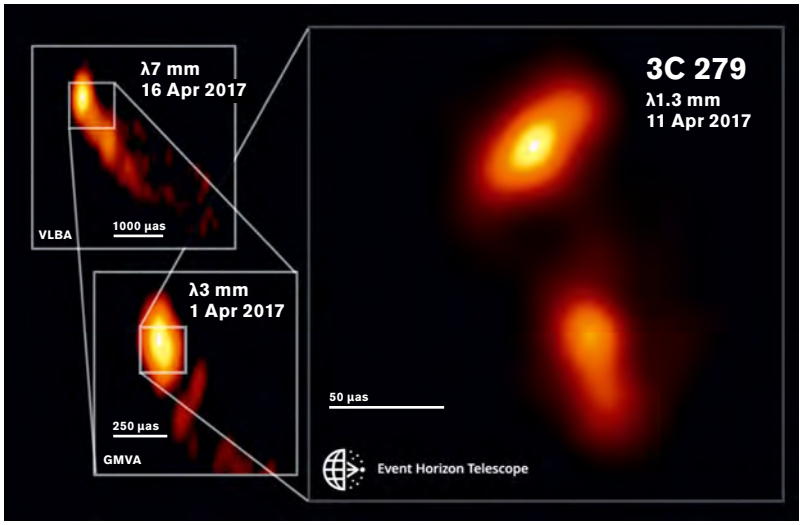
www.mpg.de/14938948 (in German)

INSIDE A QUASAR'S ENGINE ROOM

The first image of a black hole, which was successfully captured by the Event Horizon Telescope (EHT), was hailed as a scientific sensation. Almost exactly one year later, the collaborating researchers presented images of a so-called jet spewing from the black hole at the center of quasar 3C 279. Remarkable for their unprecedented detail, the photos show the gigantic mass shooting a beam of ionized gas into space at almost the speed of light. The international team led by Jae-Young Kim from the Max Planck Institute for Radio Astronomy in Bonn studied the shape of the beam near its baseline, where high-energy variable gamma radiation is believed to be generated. The telescopes linked in the EHT project show details that are shorter than a light year. This makes it possible to track the jet as far as the accretion disk believed to be at the edge of the black hole, and to observe the interaction between the disk and the jet. However, the normally straight jet appears to be twisted at its base. Furthermore, structures moving across the jet's direction of travel, presumably parts of the accretion disk, are now visible for the first time. Comparisons of images captured on consecutive days clearly show that the structure is changing, perhaps because of the collision and shredding of orbiting matter on the accretion disk and the ejection of material in the form of a jet. This scenario was previously only seen in numerical simulations.

www.mpg.de/14660592

PHOTO: J.Y. KIM (MPIFR), BOSTON UNIVERSITY BLAZAR PROGRAM AND EVENT HORIZON TELESCOPE COLLABORATION



A look inside the heart of a quasar: the images capture the jet structure at the center of 3C 279 at different wavelengths, each at increasing angular resolutions. The observation dates, the telescope arrays used and the wavelengths are noted in each panel.

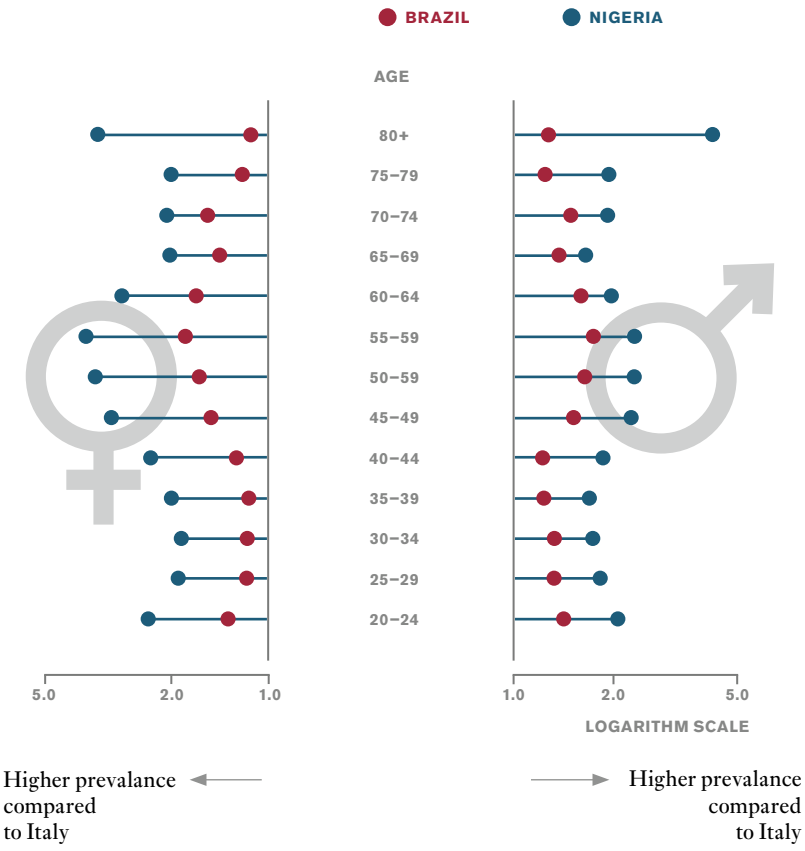
OVERCOMING THE WEAKER SELF

Although we should know better, we frequently make choices that are not good for us and then feel bad about them later on. However, we can strengthen our self-control by making simple changes to our environment. Researchers from the University of Helsinki and the Max Planck Institute for Human Development describe how psychology can be used to this end. Their advice includes using reminders and prompts, e.g. putting a photo of a carrot on the refrigerator door or putting running shoes next to the bed. Another useful idea is to give decisions a different angle: we can for example choose to welcome each flight of stairs as an opportunity to minimally increase our life expectancy. Furthermore, we should make harmful things less accessible, i.e. we should put potato chips and candy high up on the top shelf of the kitchen cabinet and keep fruit within easy reach on the table. Last but not least, we can increase our accountability by using social agreements to put ourselves under pressure, e.g. by arranging to meet other people to go jogging.

www.mpg.de/14796211

GRAPHIC: GCO

CHRONIC KIDNEY FAILURE:
BRAZIL AND NIGERIA IN COMPARISON TO ITALY



Chronic disease is more widespread in the southern hemisphere than in Europe. In Nigeria, the percentage of people in their early 20s who suffer from chronic kidney failure is about twice as high as in Italy.

WHERE COVID-19 ALSO PUTS YOUNGER PEOPLE AT RISK

For people in Europe, age is one of the risk factors that influence the severity of COVID-19. However, although the populations of many countries in the southern hemisphere are on average younger, they are no less affected by the pandemic. According to a study by the Max Planck Institute for Demographic Research in Rostock, one reason for this is that the proportion of people of working age who suffer from pre-existing conditions is significantly higher there than in Europe. In Brazil and Nigeria, for example, the number of people in their early 20s who have cardiovascular disease is more than twice as high as in Italy. Chronic renal failure and chronic obstructive pulmonary disease are significantly more widespread among 40-year-olds in Brazil and Nigeria than in Italy; in fact, it is four times more prevalent among women in Nigeria. This also significantly increases the risks associated with COVID-19.

www.mpg.de/15022135/0624

GRAPHIC: GCO, MPI FOR DEMOGRAPHIC RESEARCH

RELATIONSHIP CRISIS

Female giraffes are choosy: while they like to associate with some females, they prefer to avoid others. The result is a complex, multi-layered society of female giraffes. An international team including a researcher from the Max Planck Institute of Animal Behavior in Konstanz observed 540 female giraffes in Tanzania over a period of six years, thus gaining insight into the largest social network of wild mammals studied to date. The results showed that the animals live in discrete social groups of 60 to 90 females. These groups rarely mix, even when they share the same living space. However, humans are disrupting the animals' social environment. The researchers have observed that individual giraffes living close to villages of indigenous Masai form less strong social bonds among themselves and have less contact with other females of their species. The Masai tolerate the giraffes, but the giraffes often encounter humans and cattle around the compounds. This could be causing the groups to split up. It is particularly common for females with calves to spend time close to human settlements, possibly because this means their calves are better protected from attacks by lions and hyenas. It therefore seems that female giraffes face a trade-off between their social bonds and the safety of their calves. This disruption of their social system – along with poaching and the loss of habitat and food supply – could be why the population of Masai giraffes has declined by 50 percent in recent years. However, the researcher still have to determine how disrupted social behavior is weakening the giraffe population.

www.mpg.de/14898269

PHOTO: DEREK LEE

Masai giraffe in the Tarangire ecosystem in Northern Tanzania. Populations here have declined by half in recent years.

MICROTRANSPORTER FOR THE BLOODSTREAM

Another step has been taken towards the goal of accurately guiding medication through the bloodstream to diseased tissue. A team at the Max Planck Institute for Intelligent Systems in Stuttgart has developed a microrobot that resembles a white blood cell in size, shape and mobility. The researchers loaded a microtransporter with medicinal substances, guided it towards diseased tissue with the help of antibodies, and then rolled it through an artificial blood vessel using magnetic forces, thus simulating flow against the bloodstream. The ability to roll with and against the flow of blood in a blood vessel may make it easier to transport substances to a specific location, such as a tumor. In further tests, the microtransporters targeted cancer cells and discharged an active substance at the location.

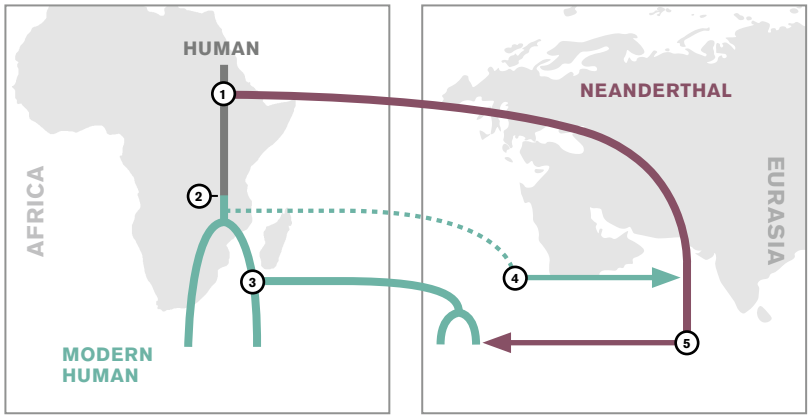
www.mpg.de/14901427

FRUITFUL ENCOUNTER

Modern humans and Neanderthals interbred many times through the millennia. This is why the genome of every person outside Africa contains an average of one to two percent of Neanderthal DNA. Some of these genetic variants were more detrimental than beneficial and disappeared from our genome as we evolved. Others were more favorable, for example a variant of the progesterone receptor gene; progesterone is a hormone that plays an important role in the menstrual cycle and during pregnancy. Researchers at the Max Planck Institute for Evolutionary Anthropology in Leipzig and the Karolinska Institute in Sweden analyzed the biobank data of more than 244,000 women and discovered that one in three European women have inherited the Neanderthal receptor gene. 29 percent carry one copy of the Neanderthal gene, while three percent actually carry two copies. This means that the proportion of women carrying a Neanderthal variant of the gene is about ten times higher than for most other genes. Women with this variant have more progesterone receptors in their cells. This means they are more sensitive to the hormone and are better protected from miscarriage and bleeding. They also give birth to more children.

www.mpg.de/14877152

GRAPHIC: GCO AFTER ILAN GRONAU



1 600,000 years ago

2 EMERGENCE OF MODERN HUMANS 300,000 years ago

3 MAIN MIGRATION < 65,000 years ago

4 EARLY MIGRATION 100,000 years ago

5 47,000 to 65,000 years ago

Modern humans and Neanderthals interbred many times throughout the course of evolution. This has left traces in human DNA.

MYSTERY OF THE SOLAR CYCLE IS ILLUMINATED

Solar activity fluctuates in a rhythm of about eleven years, which is reflected in various phenomena such as the frequency of sun spots. A complete magnetic period lasts 22 years. Researchers have long been puzzling over what causes this cycle. There must be a connection with the conditions beneath the star's "skin": a layer of hot plasma – electrically conductive gas – that covers the surface of the sun to a depth of 200,000 kilometers. The plasma inside this convection zone is constantly in motion. A team of researchers led by Laurent Gizon from the Max Planck Institute for Solar System Research has now succeeded in drawing the most comprehensive picture to date of these plasma flows in a north-south direction. The researchers found that the flow symmetry is remarkably simple: the plasma makes a single circuit lasting approximately 22 years in each solar hemisphere. In addition, the flow toward the equator at the bottom of the convection zone causes spots to form closer and closer to the equator as the solar cycle progresses, a phenomenon that has long since been reflected by the well-known butterfly diagram.

www.mpg.de/15032287

PHOTO: MPI FOR NUCLEAR PHYSICS

An extremely precise atomic balance: Pentatrap consists of five Penning traps arranged one above the other (yellow column in the middle). These traps enable ions to be measured and compared in their excited quantum state and in their ground state. In order to minimize errors, the ions are also moved back and forth between different traps for comparative measurements.

QUANTUM LEAP TIPPING THE BALANCE

A new door to the quantum world has been opened: every time an atom absorbs or releases energy via the quantum leap of an electron, it becomes heavier or lighter. This is due to the connection between energy and mass, which Albert Einstein expressed in the formula $E = mc^2$. However, in an individual atom, this effect is as minuscule as the difference in mass that an ant weighing ten milligrams would make if it were standing on an elephant weighing six tons. Nevertheless, an international group led by a team from the Max Planck Institute for Nuclear Physics in Heidelberg has succeeded in measuring this infinitesimal change in the mass of individual atoms. In order to achieve this, they used the atomic balance known as Pentatrap. The charged atoms rotate in this trap, and the lighter they are, the faster they rotate. Since the orbital frequency can be determined very accurately, the researchers can determine the mass of the atoms with exceptional precision. In this way, they discovered that the rare metal rhenium has a previously unknown quantum state that could be of interest for future use in atomic clocks. This extremely sensitive atomic balance thus facilitates a better understanding of the complex quantum world of heavy atoms.

www.mpg.de/14793234

PHOTO: PICTURE ALLIANCE / DIEKLEINERT.DE / HANS STEEN

This storm cloud over Munich threatens heavy rain – this is probably clear to most people. However, four in five Germans did not understand what was meant by the probability of rain.

UNDERSTANDING WEATHER FORECASTS

Many Germans have difficulty correctly assessing weather risks. This was the result of a representative survey conducted by the Max Planck Institute for Human Development and the Hans-Ertel Centre for Weather Research. Over one thousand Germans aged between 14 and 93 answered factual questions about the weather and its effects. A large proportion of those questioned judged the risks incorrectly. For example, 44 percent of respondents believed that ground frost, which can cause icy conditions on roads and sidewalks, can only form at air temperatures of 0 degrees Celsius or below – a misconception that can become dangerous in traffic. Moreover, two-thirds of respondents incorrectly believed that higher temperatures mean higher levels of UV radiation. And if a thunderstorm were approaching, many respondents would probably not take shelter in time: only one in five correctly estimated that a 30-second delay between a lightning flash and the sound of thunder means that a thunderstorm is about ten kilometers away. Furthermore, only one in five respondents were able to correctly interpret information about the probability of rain. The research team therefore calls for a new type of risk forecast that not only states what the weather will be, but also what damage it can cause.

www.mpg.de/14847266

A TOUCH OF GOLD AND SILVER

One might think that gold leaf, which is only 0.1 µm thick, is actually quite thin. This is far from true: in fact, it can actually be several hundred times thinner. Working in cooperation with partners in Pisa and Lund, researchers at the Max Planck Institute for Solid State Research in Stuttgart have now created crystalline layers of gold and silver that are just one atom thick. The team also found that two-dimensional gold and silver behave like semi-conductors, even though three-dimensional forms of these precious metals conduct electricity very well. This unusual electrical behavior may be due to the fact that these ordered layers of gold and silver can only be produced between a substrate of silicon carbide and a sheet of graphene, i.e. a layer of carbon atoms. When they are in two-ply layers, the metals revert to their previous state as metallic conductors. Combining single and double layers of precious metals could for example enable smaller diodes to be constructed than is possible today.

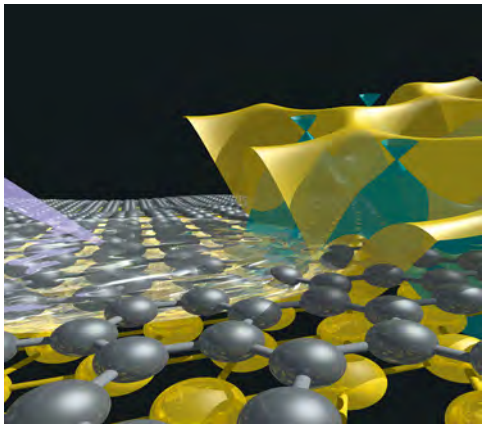


IMAGE: STIVEN FORTI

A sandwich with electronic spice: the illustration shows a crystalline, monoatomic layer of gold beneath a graphene sheet (anthracite). The electronic structure of the gold layer and the graphene (green) is shown above. The Max Planck researchers in Stuttgart investigated its electronic properties using a photon beam (on the left edge of the image).

www.mpg.de/14903250

HEAT IN SPRING, DROUGHT IN SUMMER

The conditions for the extreme drought in the summer of 2018 were created that spring. Because the spring was very hot that year, the vegetation grew rapidly and absorbed a large amount of water from the soil early on, thus intensifying the summer drought, especially in Northern and Central Europe. The seasonal connection between a warm spring and a dry summer was discovered in a simulation carried out by an international team that included scientists from the Max Planck Institute for Biogeochemistry in Jena. The unusual climatic conditions affected the carbon balance of ecosystems differently from region to region, depending on the respective vegetation. Climate change will cause the risk of drought to increase. Informed decisions as to which plants should grow where could mitigate drought periods and their impact.

www.mpg.de/14940757 (in German)

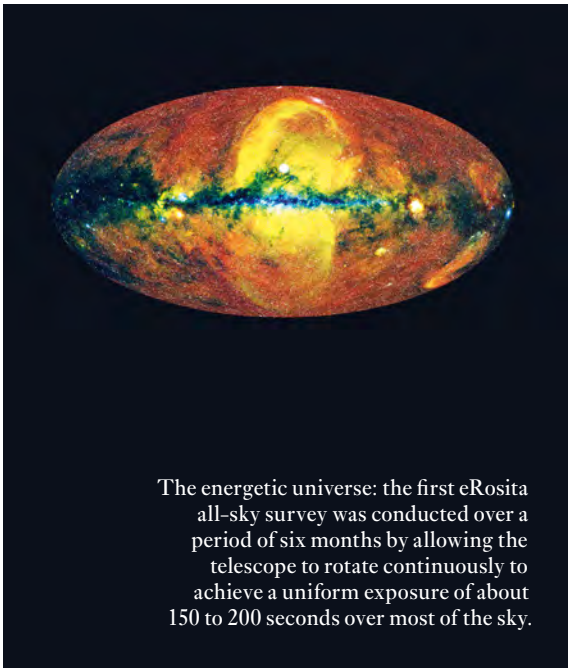


IMAGE: JEREMY SANDERS, HERMANN BRUNNER AND THE ESASS-TEAM (MPE); EUGENE CHURAZOV, MARAT GILFANOV (ON BEHALF OF IKI)

The energetic universe: the first eRosita all-sky survey was conducted over a period of six months by allowing the telescope to rotate continuously to achieve a uniform exposure of about 150 to 200 seconds over most of the sky.

OUR DEEPEST VIEW OF THE X-RAYED SKY

After 182 days, the x-ray telescope eRosita has completed its first full sweep of the sky. The resulting new map of the hot, energetic universe contains more than one million objects, roughly doubling the number of known x-ray sources discovered over the 60-year history of x-ray astronomy. Most of the new objects are active galactic nuclei at cosmological distances, marking the growth of gigantic black holes over cosmic time. "This image completely changes the way we look at the energetic universe," explains Peter Predehl, the project's Principal Investigator at the Max Planck Institute for Extraterrestrial Physics in Garching. The universe viewed by x-ray looks quite different to the view through optical or radio telescopes. Most of the sources outside our galaxy are active nuclei of other galaxies. There are also clusters of galaxies that appear as extended x-ray halos. The eRosita data are also a treasure trove of rare and exotic phenomena, including many types of variable objects, merging neutron stars, and stars being swallowed by black holes.

www.mpg.de/14999689

PHOTO MEDAL: DPA-PICTURE ALLIANCE

WHEN STOCKHOLM CALLS TWICE

PHOTO: HALLBAUER & FIORETTI

PHOTO: DEREK HENTHORN

A high honor: Emmanuelle Charpentier and Reinhard Genzel were awarded the Nobel Prizes for Chemistry and Physics by the Royal Swedish Academy of Sciences. Charpentier receives the award for her groundbreaking work on the genome-editing tool CRISPR-Cas 9, while Genzel is being honored for providing evidence of a black hole in the center of our Milky Way.

Emmanuelle Charpentier receives the Nobel Prize in Chemistry, while the Physics Nobel Prize goes to Reinhard Genzel. The first, and until now, the last time that the Max Planck Society had scooped up two different Nobel Prizes in the same week was in 1995. "I am delighted that two Max Planck researchers won a Nobel Prize this year", said President Martin Stratman. "It confirms the Max Planck Society's status as one of the most successful scientific organizations in the world and it also reinforces our mission: we do not rely on programs, but on great minds, who we provide with sufficient funds for high-risk, long-term basic research. This also makes us highly attractive on an international level for top researchers from all over the world. But above all, these two Nobel Prizes demonstrate the exciting and innovative discoveries that arise from curiosity-driven basic research."

The first cause for celebration came on the Tuesday of the Nobel Prize week in October: astrophysicist Reinhard Genzel, Director at the Max Planck Institute for Extraterrestrial Physics in Garching near Munich, was awarded the Nobel Prize in Physics – alongside U.S. physicist Andrea Ghez and UK-born mathematical physicist Roger Penrose. The Royal Swedish Academy honors the three scientists for their black hole research. "This really took me by surprise," said 68-year-old Genzel. With his group, Genzel has been using high-precision methods to detect the black hole at the center of the Milky Way through years of experimental research. He emphasized that the Nobel Prize was a success for the entire Max Planck Society, which had provided his team with the necessary resources. "I am very happy that I could win this coveted trophy for the Max Planck Society," Genzel said in an interview with the Süddeutsche Zeitung. He had not expected to win the Nobel Prize because he had already received the Crafoord Prize for Astronomy in 2012. "Usually, winning the Crafoord Prize means you are out of the race for the Nobel," Genzel said. Somewhat less surprising, but no less gratifying, was the award received one day later by Emmanuelle Charpentier. The microbiologist had for years been tipped as a favorite for the highest scientific honor from Stockholm. Together with U.S. structural biologist Jennifer Doudna, the Frenchwoman receives this year's Nobel Prize in Chemistry. The two researchers are being honored for their groundbreaking work on the genome-editing tool CRISPR-Cas9. The CRISPR-Cas9 technology is considered a revolution in the fields of medicine, biotechnology and agriculture. "I am overwhelmed and deeply honored to receive an award of such significance. I am now looking forward to celebrating the prize with my team, family, and friends via video call," said Charpentier, Director at the Max Planck Research Unit for the Science of Pathogens in Berlin.