

ECOBUS IS PICKING UP SPEED

EcoBus GmbH is all about transporting people in a more efficient and environmentally friendly manner. The recently founded company aims to bring a ride pooling system developed at the Max Planck Institute for Dynamics and Self-Organization in Goettingen into widespread use. During test runs carried out in 2018, EcoBus offered mobility services to passengers in Bad Gandersheim and the Harz mountains who did not have their own car. They were collected from their homes and taken to their destinations in minibuses. At the time, the service found itself in direct competition with regular public transport services, which is why it was suspended. Since then, however, the team at the Max Planck Institute has developed the concept further. EcoBus GmbH now intends to make

the underlying software ready for market and to market it accordingly. The idea is to combine the shuttle buses with existing public transport services, particularly in rural regions, to create a system with which passengers can travel from door to door for the price of a local public transport ticket. EcoBus offers its services to all transport companies and, besides allowing users to book regional trips, also intends to make longer journeys possible in the future.



PHOTO: ECOBUS GMBH

Taxi bus: passengers are collected from their homes in minibuses and taken to their destinations.

www.mpg.de/17032762

517 000

By the beginning of July, the “Interstellar” video had been viewed 517,000 times

BLOCKBUSTER ON YOUTUBE

The future is bleak; humanity has to leave the Earth, which is becoming increasingly uninhabitable, which is why a dozen astronauts are heading out into space to look for a new home. The excursion is unconventional because the intrepid explorers are being sent through a wormhole that leads to another galaxy – to a planetary system surrounding a black hole. With its thrilling action, scientific elements and visual effects, the movie “Interstellar” was not only well received by the public, but also won an Oscar. The astrophysicist Kip Thorne, who acted as an adviser during production, later went on to win the Nobel Prize. How scientifically accurate is the film? In the Max Planck Society’s explanatory video

series “Wissen was” with Doktor Whatson, YouTuber Cedric Engels travels into the fifth dimension with Silke Britzen of the Max Planck Institute for Radio Astronomy and Frank Ohme of the Max Planck Institute for Gravitational Physics to examine how realistic the physics is behind “Interstellar.” This takes place in an informal, illuminating conversation – and viewers appear to enjoy it: the video was viewed more than 137,000 times during the first seven weeks, and the first episode of Doktor Whatson’s discussion with the Max Planck experts on his own YouTube channel has been viewed more than 380,000 times so far.

www.mpg.de/interstellar01 (in German)
www.mpg.de/interstellar02 (in German)

TWO NEW MAX PLANCK CENTERS

Better treatments for diseases such as dementia and Parkinson’s, more powerful computers, new artificial intelligence processes – these are the goals that will be pursued by scientists at the Max Planck – University of Toronto Centre for Neural Science and Technology. The Centre was officially inaugurated in April 2021 during a virtual event attended by Max Planck President Martin Stratmann, University of Toronto President Meric Gertler, German ambassador in Canada Sabine Sparwasser, and Canadian ambassador in Germany Stéphane Dion. Just two months later, in June 2021, the green light was given for another Max Planck Center, the Max Planck – Radboud University Center. The focus of this collaboration are free-electron lasers that emit infrared light. Their potential applications range from biomedicine to chemistry and materials science to astrophysics. Laser systems of this type are extremely complex, which is why there are only a few worldwide, including the one at the Fritz Haber Institute in Berlin and another at Radboud University in Nijmegen. The amalgamation of both facilities in the new Center will facilitate an intensive exchange of experiences and new ideas for the infrared lasers.

www.mpg.de/16760851
www.mpg.de/17048779

PHOTO: THE CAPTURE GMBH



Virtual dance: the motion capture technology developed by Max Planck spin-off 'The Captury' makes it possible to capture and record movements without markers or special equipment.

ANALYZING MOVEMENTS WITH EASE

Motion capture technology can capture and record movements for playback, analysis, and further processing on the computer. This technology is commonly used in movies to bring animated characters to life. In sports and medicine, it is used to analyze and optimize movement sequences and to treat diseases and the after-effects of surgery. Conventional motion capture technology usually requires special cameras and skin-tight suits fitted with special markers, which are uncomfortable to wear and can often distort natural movement. However, a method de-

veloped at the Max Planck Institute for Informatics is now making it possible to use normal cameras to record the movements of people wearing ordinary clothing. A software program analyzes the movements and transfers them to a virtual figure. A company known as 'The Captury', which was established in Saarbruecken in 2013, has made this technology ready for market and is now marketing it. The U.S. company Dari Motion has purchased The Captury and plans to bring the technology into wider use.

www.mpg.de/16777202

RESEARCH IN SIGN LANGUAGE

Until now, deaf, and hearing-impaired people wishing to engage in scientific discussion have found that there are often no specialized signs for specific scientific terms. Sign2MINT is now closing this gap. The specialized sign dictionary, which went online in May 2021, was co-developed by the Max Planck Institute of Microstructure Physics in Halle. Compiled in German sign language, it lists specialized signs for terminology used in mathematics, physics, the geosciences, chemistry, biology, and medicine. There is already a database of short videos showing 1,135 specialized signs, and the collection is still growing. The Sign2MINT software allows the signs to be displayed on PCs, tablets, and smartphones. This means that the sign language videos are also enabled for mobile use and can be shared on social media such as WhatsApp, Facebook, and Twitter. While working on the dictionary, the Sign2MINT team had to develop a considerable proportion of the specialized signs from scratch. The project is receiving funding from the Max Planck Foundation.

www.mpg.de/16890214 (in German)

AFRICA'S OLDEST GRAVE

10 Although the earliest traces of *Homo sapiens* were found on the African continent, evidence of early burials in Africa is extremely rare, which is why the discovery of a 78,000-year-old child's skeleton at the entrance to the Panga ya Saidi cave in Kenya was an archaeological sensation. The research team, which includes scientists from the Max Planck Institute for the Science of Human History, initially discovered fragments of bone while excavating the site in 2013. However, it was not until 2017 that the small pit containing the skeleton was fully exposed; a detailed analysis took several years. The two-and-a-half to three-year-old child was buried curled up in a shallow pit directly beneath the sheltering overhang at the entrance to the cave. Since the body was lying on its right side with its knees drawn up to its chest, the researchers assume that the burial was carefully prepared, and that the body was tightly shrouded for this purpose. The position of the head also indicates that it was resting on a type of pillow. It is assumed that the community buried the child in accordance with some kind of ritual.

www.mpg.de/16809187



Fragile relics: parts of the skeleton and skull were recovered from the grave in a sediment block and were then exposed and analyzed in the lab.

PHOTO: MARTINÓN-TORRES ET AL., 2021

CATEGORICAL THINKING

A chair is a chair is a chair. This seemingly trivial insight and the associated ability to categorize things are indispensable if we want to get by in the world, because having to learn that every new chair we encounter is a chair would be extremely inefficient. Researchers at the Max Planck Institute of Neurobiology in Martinsried have now discovered that mice are also able to categorize

things. During behavioral experiments, it was found that the animals were able to classify stripe patterns either by the width or direction of the stripe. The mice learned the rules and assigned the patterns to the correct category. Whenever the researchers changed the sorting rules, the mice ignored what they had learned before and categorized the pictures using the new rule.

Studies of the mice's brains revealed that nerve cells in the prefrontal cortex became active whenever the mice sorted the stripe patterns into categories. Distinct groups of nerve cells react selectively to individual categories. The results show that it is not only humans who are capable of complex thought processes such as abstraction.

www.mpg.de/16747094

NITROGEN MAKES PLANTS THIRSTY

Plants cannot live on water and carbon dioxide alone; they also need nitrogen and phosphorus. The balance between these nutrients has a critical impact on the efficiency with which plants use water and carbon dioxide. An international team including researchers from the Max Planck Institute for Biogeochemistry in Jena has found that feeding nitrogen to small plants in a semi-arid savannah made them grow better but also increased their water consumption. However, if they were fed both nitrogen and phosphorus, the plants grew more strongly and their carbon uptake increased but they did not require more water. Among other things, the fact that a nutrient imbalance makes plants thirstier can be explained by the different effects that nitrogen and phosphorus have on plant stomata. It is not yet clear whether the nitrogen-phosphorus balance also influences water consumption in trees.

www.mpg.de/16898455

EURASIAN BLACKCAPS ARE HEADING FOR THE BRITISH ISLES

Until 50 years ago, blackcaps mostly spent the winter in the Mediterranean region. Since then, it has become increasingly common to see them in Britain and Ireland during the winter months. From there, they begin the early spring migration to their breeding grounds about ten days earlier than others of their species that spend the winter in the south, which enables them to occupy the best feeding grounds. The new migratory route is probably a consequence of the increasingly mild winters and rich supply of food found in British gardens. Researchers at the Max Planck Institute for Evolutionary Biology in Ploen have recently discovered surprising dif-

ferences between the birds that use different winter quarters. The blackcaps that are fed regularly in British gardens have smaller fat reserves. Apparently, they do not need to store as much energy because the food put out in British gardens offers a reliable supply of nutrients, which also means that they are more agile and can escape from predators more easily. These birds also have longer beaks, presumably due to the wider range of food available to supplement their natural diet of insects. The tips of their wings are also rounder, probably because they are less mobile than others of their species in the south.

www.mpg.de/16715680 (in German)

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PHOTO: BENEHARO RODRIGUEZ

Blackcaps are exploring new winter quarters.

The spike protein is connected to the coronavirus membrane via a narrow bridge. The surface areas marked in violet are not protected by sugar molecules (green) and could therefore be potential targets for antibodies.

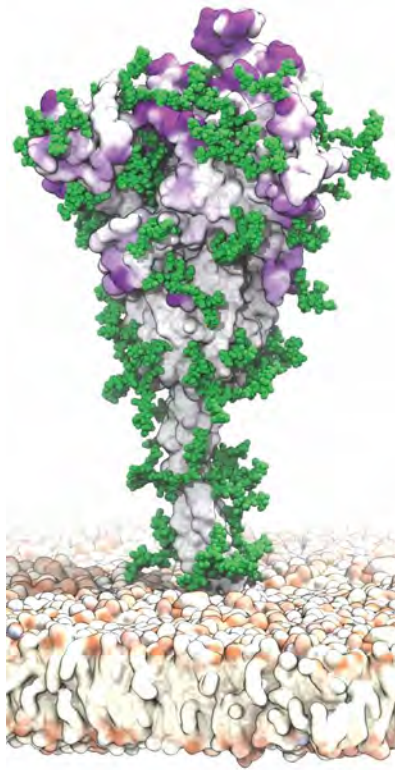


IMAGE: MPI OF BIOPHYSICS/MATEUSZ SIKORA ET AL.

A SHIELD FULL OF HOLES

Hardly any other protein has become as famous as the spike protein of the Sars-CoV-2 coronavirus. The virus uses the protein extending from its surface to dock onto human cells. While antibodies produced by the immune system can easily bond with the upper part of the spike protein, other parts of the protein are protected by chains of sugar molecules known as glycans, which prevent the immune system from recognizing them. A detailed model created by researchers at the Max Planck Institute of Biophysics shows that the glycans act like a dynamic protective shield with which the virus can evade the human immune system. These sugar molecules move backwards and forwards like the windscreen wipers on a car, thus covering a large part of the protein surface even though the coverage may only be minimal at any given time. The researchers have identified certain spots that are least protected by the glycan shields, which could be used to develop vaccines against new variants of the virus.

www.mpg.de/1665252

BEATING THEIR OWN DRUM

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For many animals, it is their body size that determines how successful they are when competing with other members of their species and attracting a mate. They try to make their size unequivocally clear to their rivals in order to avoid potentially bloody fights. Male gorillas do this by rapidly beating their chests with cupped hands. The drumming sound, which can be heard more than a kilometer away, is presumably intended to intimidate rival males and attract females. Researchers at the Max Planck Institute for Evolutionary Anthropology in Leipzig recorded the chest-beating sounds of mountain gorillas in the Volcanoes National Park in Rwanda and then measured the animals' body sizes. They discovered that the chest-beating sound made by larger males is deeper than that of smaller ones, which means that male gorillas can use the sound of chest beating to make reliable estimates of their rival's body size from a distance. Because larger individuals are more dominant, they can then decide whether it is worth initiating a fight. Females, on the other hand, probably use this information when choosing a mate.

www.mpg.de/16678047

Male mountain gorilla beating its chest.



PHOTO: DIAN FOSSEY GORILLA FUND

CAMPFIRES ON THE SUN

A total solar eclipse puts a crown on the sun: a diffuse light shines around the darkened disk. This corona extends millions of kilometers into space. Researchers have been puzzling over the temperature of the sun's outermost layer for many years: while the visible surface of the sun has a temperature of around 5500 degrees, temperatures in the corona increase to over a million degrees. The European space probe Solar Orbiter has now discovered small, bright re-

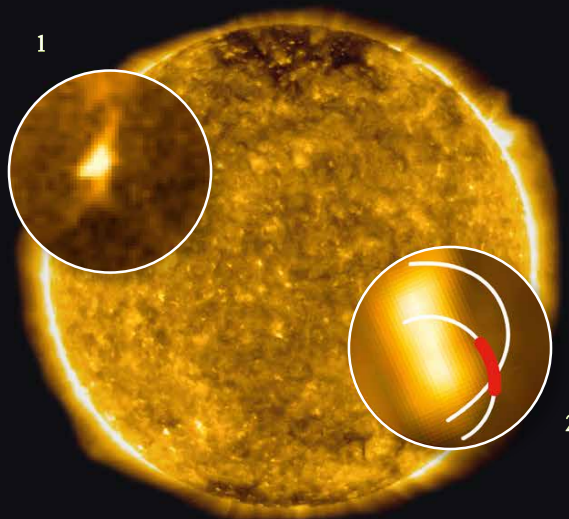
gions in the lower areas of the corona. These flares, which are only 400 to 4,000 kilometers in size, occur significantly more often than their larger equivalents, with which scientists are already familiar; like these, the smaller outbursts are caused by a kind of magnetic short circuit in the solar plasma. The scientists have studied about 1,500 of these solar campfires so far. They found that the flares only last a few minutes and reach temperatures of more than one

million degrees – possibly contributing to the immense heat in the corona. However, according to Hardi Peter of the Max Planck Institute for Solar System Research, their impact depends on more than just their frequency. The amount of energy they contribute to the corona's total energy balance, he says, is equally important – this is one of the questions that computer simulations will be attempting to answer.

www.mpg.de/16788408

A close look at the sun: the campfires (1) are areas in the lower corona measuring about 400 to 4,000 kilometers which emit short bursts of high-intensity ultra-violet light on extremely short wavelengths. They are caused by short circuits in the magnet field lines (2).

IMAGE: SOLAR ORBITER/EUI TEAM/ESA & NASA



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EVEN EDUCATED BRAINS DETERIORATE

The human brain shrinks during adulthood. The prevailing scientific opinion to date has been that higher levels of education can slow down or even stop the shrinkage. However, research carried out by the EU consortium "Lifebrain" on the basis of several large-scale long-term studies has

now refuted this assumption. The team, which includes researchers from eight countries and several scientists from the Max Planck Institute for Human Development, analyzed the role which education plays in mental deterioration. The results showed that some areas of the brain

were indeed larger in study participants who had spent more time at school and in higher education. However, with increasing age, people with higher levels of education experienced just as much brain shrinkage as individuals with lower levels.

www.mpg.de/16828246 (in German)

A fading burst: the H.E.S.S. sky maps of GRB 190829A shows the vanishing of the afterglow over three nights of observation (from left).

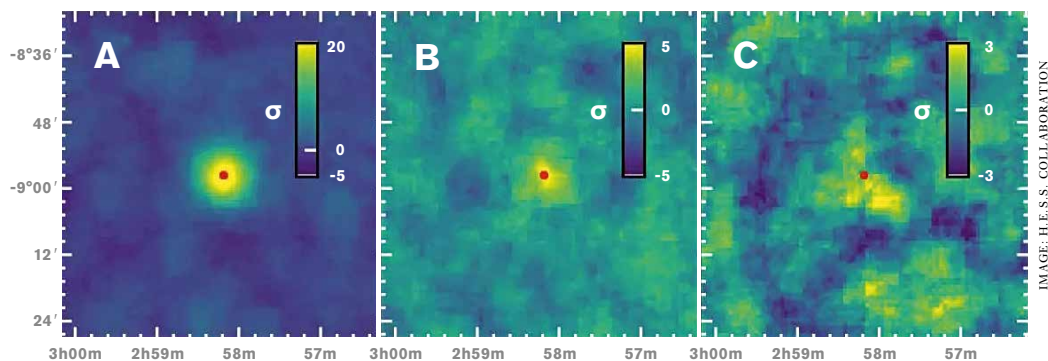


IMAGE: H.E.S.S. COLLABORATION

KNOWLEDGE EXPANSION FOR COMPUTERS

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Many guests would probably find it a matter of importance if a hotel had no elevator. For the most part, however, search queries sent to booking portal algorithms currently only return information on existing facilities, e.g., that a hotel room has a balcony or an en-suite bathroom. A team from the Max Planck Institute for Informatics in Saarbruecken has now developed a process with which statements can be made about properties missing from a search object. This method can automatically generate knowledge about missing attributes for databases, whereby it is important that the algorithm identifies the relevant statements among the countless negative statements that can be made about an object. To do so, the algorithm considers whether a specific applicable attribute is mentioned in similar search queries. If, for example, hotel elevators are frequently mentioned in corresponding responses, the algorithm concludes that it is important if the hotel has none. Access to this type of knowledge could not only improve the recommendations made by booking portals, but also those provided by online shops.

www.mpg.de/16785381

UNUSUAL GAMMA-RAY BURST

Gamma-ray bursts are some of the most powerful explosions in the universe, releasing more energy in just a few seconds than the sun does over billions of years. It is assumed that this elemental force is released when a massive star collapses into itself and forms a black hole. Part of the energy set free initiates a shock wave which accelerates electrons to almost the speed of light and causes a high-energy gamma-ray burst at the same time. A team of researchers, which includes scientists from the Max Planck Institute for Nuclear Physics, has now

tracked the afterglow of such an ultra-high-speed gamma-ray burst using the H.E.S.S. Telescope in Namibia. Surprisingly, the gamma-ray spectrum of this event, which has been named GRB 190829A, resembles that of the much lower-energy x-ray spectrum. The afterglow in both bands also faded in parallel over a period of three days. Until now, gamma-ray and x-ray radiation had been thought to originate in different processes and to behave differently. This theory now appears to be in doubt.

www.mpg.de/16999277

RISK FACTORS ARE LESS DECISIVE IN OLD AGE

People who smoke or suffer from high blood pressure, obesity or diabetes are not only at greater risk of suffering a stroke, heart attack or dementia, but are also more likely to develop depression or depressive moods. The more risk factors a person has, the more likely this is. Until now, however, it has not been clear whether this probability also depends on their age. For other diseases such as dementia or strokes, earlier studies had already shown that a combination of

several risk factors between the ages of 40 and 65 mean that the disease is more likely to develop than if the same risk factors are present in old age. Researchers at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig and the University of Muenster have now discovered that the same applies to depression. The risk factors for depression are also less decisive in people aged over 65.

www.mpg.de/16901631

NANOPROTECTION FOR BATTERIES

Solid-state batteries could help electric cars achieve longer ranges than the lithium batteries currently in use. They are also safer; however, they are not yet durable enough. A team of researchers from the Fritz Haber Institute, the TU Munich and Forschungszentrum Jülich have now found a way to extend the life of solid-state batteries. The researchers found that irregular, nanometer-thin layers at the boundaries between the tiny crystalline grains in solid-state electrolytes can stabilize the batteries. Until now, researchers have tried to make the irregular layers as thin as possible so that the charge can be transported through the electrolytes with maximum efficiency. However, these new findings could change the way they think because the layers block the path of electrons, which could not only cause short circuits but could also contribute to the growth of metallic dendrites, which could also cause short circuits and destroy the battery. With regard to the thickness of the nanolayers, it could therefore be expedient to seek a compromise between efficient charge transport and protection against short circuits.

www.mpg.de/0220211en

Electron microscope image of a solid-state electrolyte: the crystalline grains have a regular structure (left and right), whereas the boundary layer is irregular. The central section is simulated.

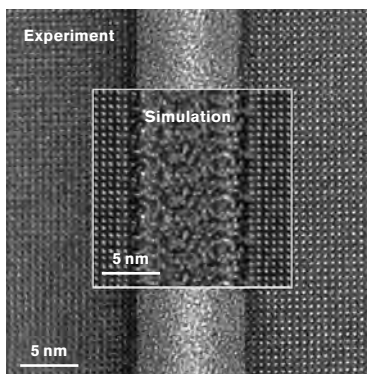


IMAGE: STEGMAIER ET AL., ADVANCED ENERGY MATERIALS 2021



PHOTO: LIZA SUMMER/PEXELS

Crying out for understanding: intensive expression of emotions can often no longer be clearly interpreted.

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STRONG EMOTIONS – DIFFICULT TO UNDERSTAND

The sound of a person's voice reveals a lot about how they are feeling. But how well can we interpret the emotional communications of others? For the first time, a team comprising scientists from the Max Planck Institute for Empirical Aesthetics and researchers from New York has studied the relationship between emotional intensity and the associated vocal expressions. They recorded a number of non-verbal sounds that express various positive and negative emotions, such as screams, laughter, sighs, moans, and groans, which ranged in intensity from minimal to

extreme. They then looked into how clearly listeners understand these sounds depending on their emotional intensity. As expected, emotions initially became easier to interpret as their intensity increased. However, the more intense the expression of feelings became, the more difficult they were to understand. In the case of extreme emotions, the ability to interpret them correctly fell dramatically. Expressions of the most intense emotions were therefore the most difficult to interpret.

www.mpg.de/0220212en