Songbirds with a Casanova Gene

Females inherit an "infidelity gene" from their fathers

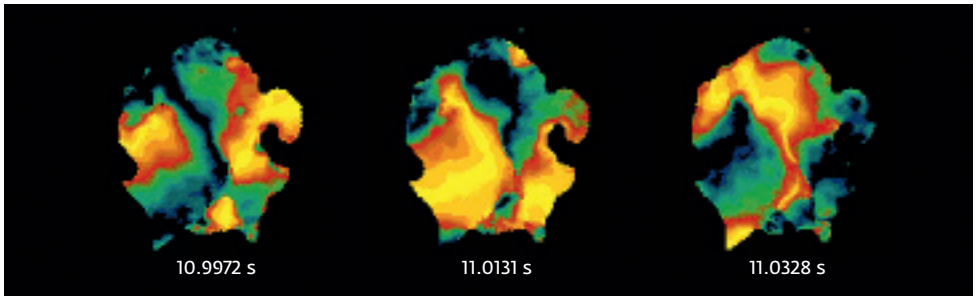
Many birds are considered to be monogamous. In actual fact, however, in numerous pairs, one of the partners is unfaithful. This behavior has obvious benefits for the male, as it allows him to increase the number of offspring he produces, but it is somewhat less advantageous for females. Scientists at the Max Planck Institute for Ornithology in Seewiesen have now found a surprising explanation for why female zebra finches nevertheless actively seek other males: it appears that they inherit their willingness to play away from home from their fathers; there is no reason why infidelity should pay dividends for them. It is sufficient for the male parent to benefit from their promiscuity. This "Casanova gene" thus spreads among a population as long as the benefit to the male gene carriers is greater than the cost to the females. (PNAS, June 13, 2011)

Zebra finch pair with a love rival. It is possible that only the males benefit from straying.

Gently Restarting the Heart

Atrial fibrillation is better treated with several weak shocks than with one strong one

It may soon be possible to treat cardiac arrhythmias gently and painlessly. A team of researchers working with scientists from the Max Planck Institute for Dynamics and Self-Organization in Göttingen and from Cornell University in Ithaca in the US has used several weak shocks rather than one very strong one to halt atrial fibrillation in an animal model. Cardiac fibrillation results when electrical signals from the body propagate in chaotic waves and disrupt the regular heartbeat. The strong pulse of a defibrillator interrupts the chaotic waves with one shock and restarts the heartbeat – much like briefly switching a computer off and then on again. The weak shocks stop the chaotic waves in several steps and use 84 percent less energy. This method is therefore not as painful as the one that is currently in regular use, which is usually applied under general anesthesia. (Nature, July 14, 2011)



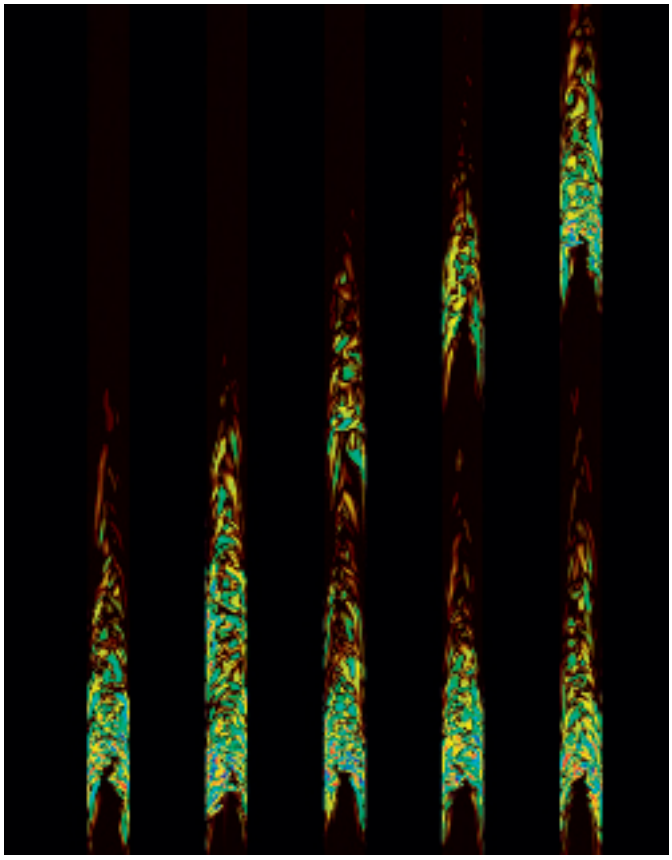
Cardiac arrhythmia on film: Three snapshots taken in rapid succession of the chaotic excitation in a heart (black – at rest, yellow – excited). This situation can stop the pumping function of the heart and cause sudden cardiac death.

Photos: dpa Picture-Alliance (top); MPI for Dynamics and Self-Organization) (bottom)

From Minor Eddies to Turbulence

Max Planck researchers observe the development of turbulence in liquids

Expensive, difficult to control and, until now, little understood: turbulence impedes the transport of oil and gas through pipelines. Researchers working with Björn Hof at the Max Planck Institute for Dynamics and Self-Organization in Göttingen determined the flow speed at which turbulence develops in liquids and gases as they surge through a pipe. They examined small eddies that either died away or split or acted as starting points for greater turbulence. The researchers determined, for liquids, the speed at which more eddies were created than disappear, thus finding the critical point for turbulence. A better understanding of turbulence could help in developing techniques with which it can be eliminated without a great deal of energy. (Nature Physics, June 5, 2011)



Turbulent scenes in a water pipe: A small "puff" or eddy splits into two (from left).

Cold Plasma Eliminates EHEC Bacteria

Initial experiments show that device prototypes that are suitable for everyday use drastically reduce the numbers of dangerous pathogens

Combating EHEC bacteria: Consumers may be able to use this device to remove dangerous bacteria, such as the EHEC 0104:H4 pathogen, from food in their own kitchens. Treatment with this device reduces a colony of bacteria to one one-hundred-thousandth of its former size after just 15 seconds. The device can be manufactured for around 100 euros.

It may be possible to prevent another wave of infections from EHEC bacteria. Scientists at the Max Planck Institute for Extraterrestrial Physics in Garching and Munich's Schwabing Clinic used cold plasma to kill different strains of the EHEC bacteria. One of these was the 0104:H4 strain that caused an outbreak in which thousands of people became seriously ill in the early summer of this year. Cold plasma consists of a gas that is strongly ionized at moderate temperatures. For their experiments, the researchers used prototypes of low-cost devices for sterilizing food in commercial operations and private households. Whether the quality of the food suffers from the surface treatment, which lasts only a few seconds, remains to be tested, but the researchers in Garching believe that any impairment is very unlikely.

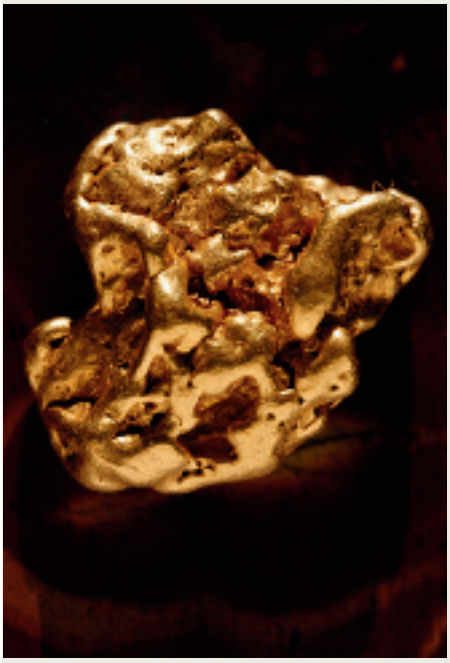
Photos: MPI for Dynamics and Self-Organization (top); MPI for Extraterrestrial Physics (bottom)

Sharing Is Child's Play

Even three-years-olds give toys to another child if they were jointly earned

Children sometimes seem to be very selfish at first glance: if they are given a reward without having earned it for any obvious reason, they rarely share it with others. According to scientists at the Max Planck Institute, this behavior changes if children have earned the reward jointly. In the study, children of ages two to three years were asked to pull together on a rope to bring a board with marbles closer to them. In this situation, they shared the property they acquired. However, when a child obtained the marbles on its own, it didn't hand over any of them. This would seem to indicate that it is typical human behavior to share the proceeds of joint efforts. After all, our closest relatives, chimpanzees, are rarely generous – even if they worked together to acquire something. (Nature, July 20, 2011)

Even small children know who has earned a reward.



Cosmic Collisions Forge Gold

Researchers identify neutron stars as factories for heavy elements

It seems that the location at which the heaviest chemical elements, such as lead and gold, are formed has been found: the violent collisions of merging neutron stars make ideal production sites. Using detailed numerical simulations, scientists at the Max Planck Institute for Astrophysics, working with Thomas Janka from the Excellence Cluster Universe and the Free University of Brussels have confirmed that this is where the relevant nuclear reactions take place. Elements heavier than iron are formed when uncharged neutrons are captured on moderately heavy seed nuclei in the r-process (r for rapid). The calculations show how tidal and pressure forces eject several Jupiter-masses of extremely hot material within a few thousandths of a second of the neutron stars' merging. As this plasma cools to temperatures below 10 billion degrees, various nuclear reactions are set off, including the r-process. (The Astrophysical Journal, September 10, 2011)

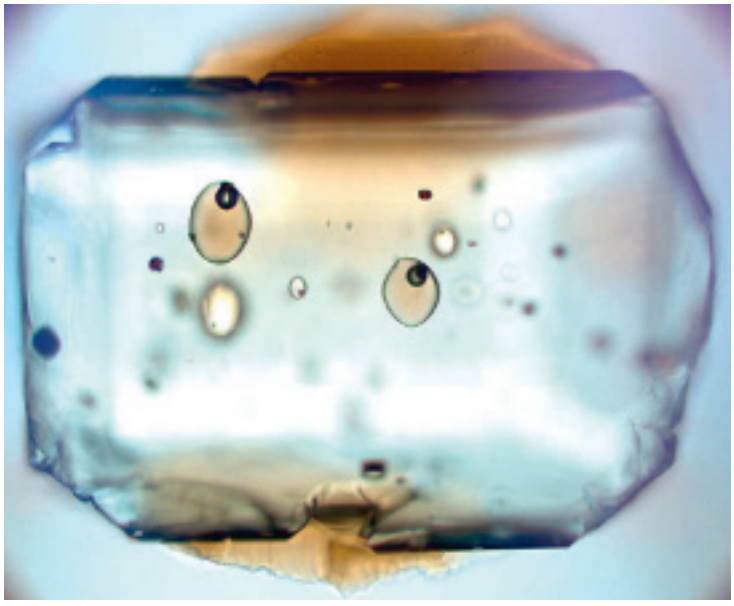
Where is gold created? For a long time, it was not known where the cosmic source of this rare precious metal (shown here as natural nuggets from California and Australia) and other heavy chemical elements was located. Now, theoretical models have confirmed the suspicion that gold might be created in the collision of two neutron stars.

Photos: MPI for Evolutionary Anthropology (top); SPL Agentur Focus (bottom)

Volcanoes as Rapid Recycling Plants

Oceanic crust reappears on the surface just 500 million years after sinking away

Geo-recycling in volcanoes is a much faster process than scientists previously assumed. Rock from the Earth's mantle that falls into the interior of the Earth from the ocean floor as a result of tectonic movement is returned to the surface via volcanoes after around just 500 million years – not, as previously assumed, after 2 billion years. Researchers from the Max Planck Institute for Chemistry in Mainz determined this using volcanic rock samples from Hawaii, analyzing the strontium isotope ratio in the remains of seawater inclusions in basalt. As the isotope ratio depends on when the water entered the rock, it is also possible to determine the age of the basalt. (Nature, August 10, 2011)

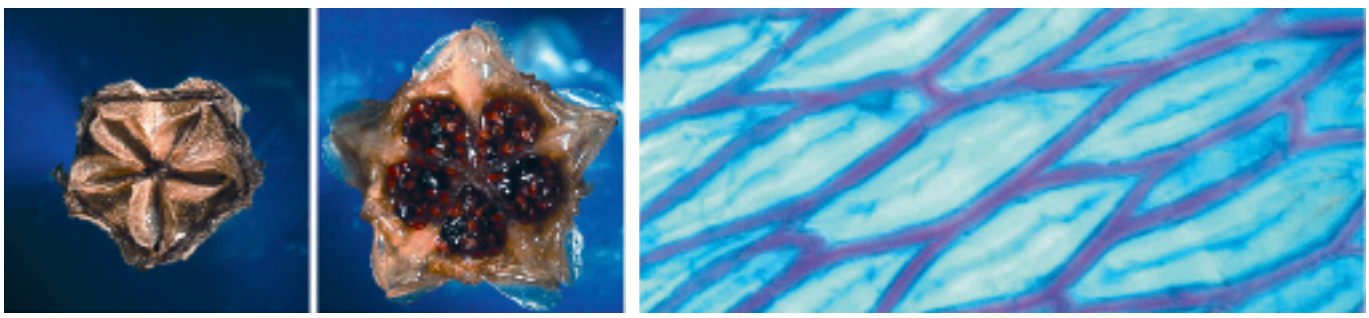


A witness to the history of the Earth: When this olivine crystal, which measures just under one millimeter in width, was created, it was penetrated by melt droplets that hardened to a glassy brown oval shape. The black dots are gas bubbles. The glassy inclusions contain strontium isotope ratios that occurred in seawater 500 million years ago.

Origami on a Seed Capsule

Ice plants have a clever opening mechanism to ensure that their seeds germinate

Some plants have an almost artistic method of seed dispersal: The seed capsules of the ice plant *Delosperma nakurense*, for example, unfold the lids of their seed capsules like a moveable piece of origami as soon as they are moistened by rain. Matt Harrington and his colleagues at the Max Planck Institute of Colloids and Interfaces in Potsdam discovered this in a detailed examination of the opening mechanism. The lids open because honeycomb-shaped cells on their interior absorb water and change their structure. When they dry, the lids close again and curve inward so that the seed chambers are tightly covered and can't open accidentally. In this way, the plant improves the chances that its seed will germinate in very dry areas. Taking this as their model, the researchers now want to develop materials that move when they become wet or when their temperature changes. (Nature Communications, June 7, 2011)



The seed capsules of the ice plant, *D. nakurense*, open at the right time. During dry periods, five lids close the capsule (left). As soon as it rains, the five lids on the capsule open (center). They are pushed open by tissue that swells as it becomes saturated with water (right).

Photos: Sobolev/MPI for Chemistry (top); Matt Harrington/MPI for Colloids and Interfaces (bottom)

Nitrogen from the Soil Mixes with the Air

Since the mid-19th century, nitrogen in agricultural areas – as well as in woodlands and wetlands – has doubled, due primarily to fertilizers. This has had a number of different effects on the atmosphere. On balance, it is suspected that fertilizer has a more detrimental effect on the climate. On the other hand, however, it improves its ability to self-cleanse.

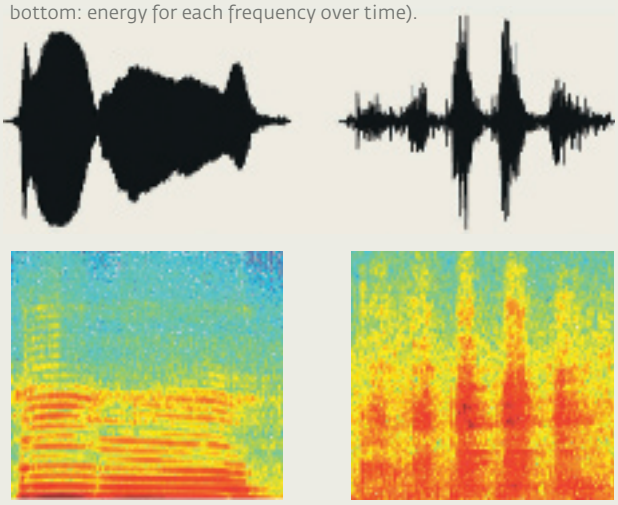
The impact of soil nitrogen on the atmosphere can vary widely, as two current studies show. It is suspected that nitrogen fertilizers are increasing the greenhouse effect in this way. Although fertilized soil speeds up the growth of plants, allowing terrestrial ecosystems to absorb more carbon dioxide from the atmosphere, it simultaneously releases more nitrous oxide – a much more significant greenhouse gas than carbon dioxide. Calculations done by a team of researchers working with Sönke Zehle at the Max Planck Institute for Biogeochemistry reveal that the damage caused by the addition of nitrogen slightly exceeds the benefits. Nitrogen fertilizers do, however, also have a positive effect on the atmosphere. Ulrich Pöschl and his colleagues at the Max Planck Institute for Chemistry have found that it strengthens the atmosphere's ability to purify itself. Their study has shown that nitrous oxide is released from fertilized arable land and enters the atmosphere – the more acid the soil, the more nitrous oxide is released. In the air, it causes hydroxyl radicals to form, which oxidize pollutants, allowing them to be washed out.
(Nature Geoscience, July 31, 2011)

Voice Cells Know Who's Talking

Special nerve cells in monkey brains recognize the voices of members of the same species

A human's voice is as characteristic as his or her face. There are probably even nerve cells in our brains that specialize in recognizing voices. In the brains of rhesus monkeys, researchers at the Max Planck Institute for Biological Cybernetics in Tübingen found neurons that are activated only by calls and sounds made by members of their species. These "voice" cells are in the temporal lobes of the cerebral cortex and respond twice as strongly to voices of members of the same species as they do to voices of other animals or other sounds. Like humans, rhesus monkeys have cells for recognizing faces in addition to voice cells. However, voice cells can distinguish more accurately between individual voices than face cells can between individual faces – possibly because there is more similarity between faces than voices. The researchers suspect that humans also have specialized nerve cells for recognizing voices. This is also indicated by the phenomenon of phonagnosia, an impairment suffered by humans who cannot identify familiar voices. (Current Biology, August 23, 2011)

Two rhesus monkey calls (top: amplitude of the sounds over time; bottom: energy for each frequency over time).

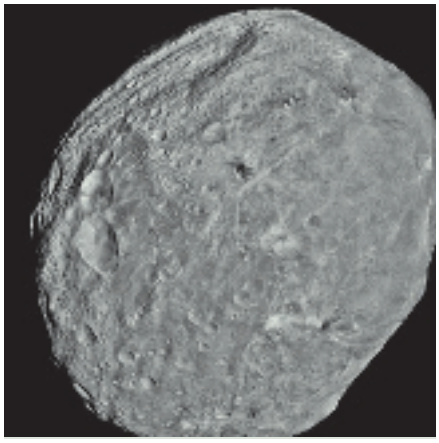


Photos and graphic: dpa Picture-Alliance (top); MPI for Biological Cybernetics – Catherine Perrodin

Vesta Has Two Faces

The first high-resolution images of the asteroid hint at an exciting past

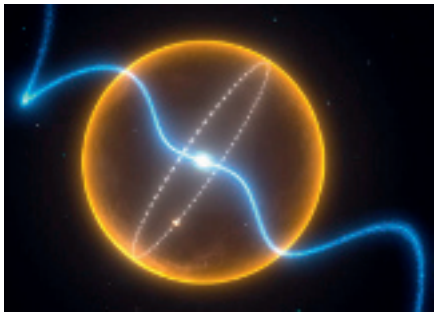
Vesta is a piece of cosmic luck: A small planet with a diameter of approximately 530 kilometers, it moves round the Sun in the asteroid belt on the far side of Mars' orbit, and is believed to be one of the few elements remaining from the birth of the planetary system, which took place around 4.5 billion years ago. Scientists from the Max Planck Institute for Solar System Research had thus been waiting impatiently for results from their camera on the *Dawn* space probe. They saw the first images at the end of July – and were immediately surprised: Vesta seems to be divided in two. The northern hemisphere exhibits many craters; the southern hemisphere, in contrast, shows far fewer. The number of craters on the surface of a planet is used to gauge its age. The older a surface is, the longer it has been exposed to the bombardment of cosmic fragments. The images show that many processes have shaped the surface of Vesta over time.



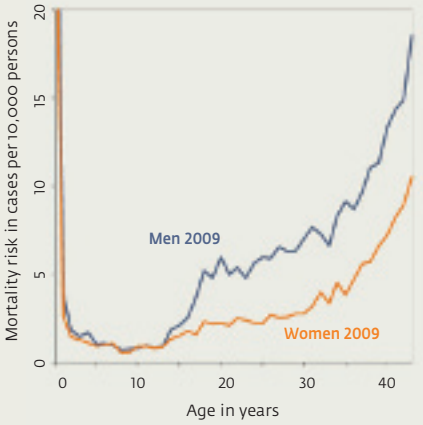
Insight into a strange world: The camera system on board *Dawn* took this photo of Vesta on July 24 from a distance of 5,200 kilometers.

The Diamond Planet

A star that changes into a planet made of diamonds? Although this sounds like science fiction, it appears to be reality. The discovery was made by an international team that included Michael Kramer from the Max Planck Institute for Radio Astronomy in Bonn. The diamond planet orbits an unusual star of extremely high density, a pulsar. This is a rapidly rotating neutron star, approximately the size of a city such as Cologne, that transmits a densely bundled beam of radio waves. Astronomers noticed regular modulation in the times the signals arrived from this recently discovered pulsar, PSRJ1719-1438. This "interference" appears to be caused by the gravity exerted by a companion with low mass. The type of modulation revealed some information to the researchers about the small heavenly body: it is approximately half as big as Jupiter, with a diameter of just 60,000 kilometers. It orbits the pulsar in 2 hours and 10 minutes at a distance of 60,000 kilometers. And it should have been torn apart by gravity a long time ago – unless it is as dense as diamond. (Science, August 26, 2011)



A strange pair: The images show the millisecond pulsar PSR J1719-1438 with a 5.7 ms pulse period in the center, and the orbit of the planet compared to the size of the Sun (shown in yellow).



Deadly recklessness: Accident rates among young men increase during puberty.

Live Fast, Die Young

Young men are becoming sexually mature at an increasingly earlier age

For young men, the risk of dying soars during puberty, when they are producing the most testosterone. This is because they take particularly big risks at this stage of their lives and often die in accidents. Scientists at the Max Planck Institute for Demographic Research in Rostock used this phenomenon to help them determine the age at which young men have become sexually mature over the last 150 years. Their research showed that, since the mid-18th century, sexual maturity in boys has occurred around two and a half months earlier per decade. This means that an 18-year-old today is as physically developed as a 22-year-old in 1800. The reason appears to be improvements in health. This may also show that the same applies to boys as was already known for girls: the period in which young people are sexually mature, but are not considered adults in social terms, is becoming longer. (PLOS, August 16, 2011)

Photos: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA (top); Matthew Bailes – Swinburne University of Technology (bottom)
Graphic: MPI for Demographic Research, Human Mortality Database (top right)