

## PLANETARY SCIENCE

## Methane-filled canyons on Titan

The surface of Saturn's largest moon is etched with canyons that are flooded with liquid hydrocarbons, according to data from NASA's Cassini spacecraft.

Valerio Poggiali of the Sapienza University of Rome and his team used radar aboard Cassini to measure elevations on Titan and map out a network of steep-sided, narrow channels called Vid Flumina. Some of the canyons are up to 570 metres deep. Titan has low average temperatures of  $-179^{\circ}\text{C}$ , so it previously wasn't clear whether the dark material in these canyons was ice. However, the scientists found that liquid methane flows through the channels and into the northern sea, Ligeia Mare.

Other than Earth, Titan is the only planetary body in the Solar System that has active erosion caused by liquid on its surface.

*Geophys. Res. Lett.* <http://doi.org/bn2p> (2016)

## NANOMATERIALS

## Sunlight helps to purify water

Nanometre-thin films can harvest natural light and use it to rapidly disinfect water.

Sunlight offers a useful means of purifying water, particularly in countries that lack reliable energy sources. Ultraviolet light is widely used to kill microbes, but accounts for only 4% of the solar spectrum. Yi Cui and his colleagues at Stanford University in California have developed a film — comprising vertically aligned layers of molybdenum disulfide — that captures visible light, taking advantage of about 50% of the total solar energy. Light causes the films to generate reactive oxygen molecules, which kill water-borne pathogens.

Placing the film in water containing *Escherichia coli* and exposing it to light led

to near-total disinfection in 20 minutes. Previous systems needed 30 to 60 minutes.

*Nature Nanotechnol.* <http://dx.doi.org/10.1038/nnano.2016.138> (2016)

## GEOPHYSICS

## Ancient sea floor preserved

The eastern Mediterranean Sea contains a surprisingly ancient chunk of oceanic crust, which is probably helping to shape the region's geology today.

The shifting of Earth's crustal plates has destroyed most oceanic rock older than about 200 million years. Roi Granot at Ben-Gurion University of the Negev in Beer-Sheva, Israel, investigated hints that the Herodotus Basin in the eastern Mediterranean might be older than that. Data from ship-towed instruments revealed long stripes of alternating magnetism on the Herodotus sea floor — a characteristic suggesting that it is oceanic, rather than continental, crust. The geometry of the stripes indicates that the crust dates back some 340 million years.

Earthquakes are a frequent occurrence on the sea floor where this relatively strong ancient crust meets weaker continental crust to the east. *Nature Geosci.* <http://dx.doi.org/10.1038/ngeo2784> (2016)

## ANIMAL COGNITION

## Crafty crows bend their tools

Creating bent tools to fish for food in holes and crevices seems to come naturally

to a species of crow.

In 2002, a captive New Caledonian crow (*Corvus moneduloides*) called Betty astonished scientists by bending straight pieces of wire into hooked tools to access out-of-reach food. But recent field experiments by Christian Rutz and his colleagues at the University of St Andrews, UK, show that bending is used by wild New Caledonian crows, too (pictured). More than half of the 18 wild-caught crows in the study bent sticks during routine tool manufacture, using methods similar to those used by Betty to handle wire. Most birds stood on the sticks and pulled the tip up.

This discovery suggests that bending may have been part of Betty's natural tool-crafting repertoire, rather than a smart invention.

*R. Soc. Open Sci.* 3, 160439 (2016)

## ZOOLOGY

## Sharks live for centuries

A shark species found in Arctic seas may live for up to 400 years, making it the longest-lived vertebrate known.

Julius Nielsen at the University of Copenhagen and his colleagues estimated the ages of 28 female Greenland sharks (*Somniosus microcephalus*; pictured), by radiocarbon dating the nuclei in the animals' eye lens. They concluded that the animals have a lifespan of at least 272 years, and that females don't reach sexual maturity until they are more than 100 years old.

The findings raise concerns



about Greenland shark conservation, because a species that takes so long to begin reproducing could be at risk of being over-exploited by fisheries. The animal is also often inadvertently captured in nets cast for other species. *Science* 353, 702–704 (2016)

## ATOMIC PHYSICS

## Proton-size puzzle deepens

Atomic measurements add weight to recent work suggesting that the proton is significantly smaller than previously thought.

In 2010, researchers studied muonic hydrogen (in which the electron is replaced with a muon, a bigger particle that is also negatively charged), which allowed them to measure the nuclear radius much more accurately than is possible with ordinary hydrogen. The proton size they found was smaller than expected from previous measurements. To confirm the results, the same team, led by Randolph Pohl of the Max-Planck Institute for Quantum Optics in Garching, Germany, studied the nucleus of muonic deuterium, which contains a proton and a neutron. They calculated that the proton radius is about 5% smaller than previously measured — a similar result to that of 2010.

Several laboratories are redoing the measurements in ordinary hydrogen atoms to try to resolve the contradiction. *Science* 353, 669–673 (2016)

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