Astronomy

Galileo encounters intense dust storm

Just 2 months before its long-awaited rendezvous with Jupiter, the Galileo spacecraft continues to plow through the most intense interplanetary dust storm ever measured. Scientists first learned of the storm on July 28, when the craft relayed data from its dust detector, says Carol Polanskey of NASA's Jet Propulsion Laboratory in Pasadena, Calif. The storm has a higher density of dust than the two other storms encountered by Galileo, last December and March.

The amount of dust found during the current storm has varied enormously from day to day. But at the storm's peak a few weeks ago, Galileo detected 20,000 dust particles per day, much more than the typical interplanetary rate of one particle every 3 days, notes Eberhard Grun, principal investigator of the dust detector and a researcher at the Max Planck Institute for Nuclear Physics in Heidelberg, Germany.

Estimates of the size and velocity of the dust particles vary. According to one model, they have a diameter of about one-tenth of a micrometer—roughly the size of smoke particles—and a velocity of 40 kilometers per second. But 1992 data from the Ulysses craft suggest that the particles are one-tenth that size and four to five times that speed. Even at the higher speed, the particles are too small to damage the craft, scientists note.

Polanskey says the dust appears to emanate from Jupiter's vicinity. "The [dust detector] spins with the craft, and it only sees the dust when it points at Jupiter," she says. Researchers suggest that the dust may originate from a combination of three sources: Jupiter's two faint dust rings, volcanic eruptions on Jupiter's moon Io, and debris left over from the collision of Comet Shoemaker-Levy 9 with Jupiter last year. However, the Ulysses craft detected significant amounts of dust near Jupiter in 1992, before the comet fragmented.

Sometime after Dec. 7, when Galileo begins a 2-year tour of Jupiter and its moons, scientists will probably acquire data that can pinpoint the source of the dust storms. For instance, whenever Io and Jupiter lie on opposite sides of the craft, Galileo will be able to determine whether the dust comes from the volcanically active moon or the giant planet.

In the meantime, notes Polanskey, Galileo may encounter an even greater storm next month, when the craft enters Jupiter's magnetosphere. In this huge region surrounding Jupiter, the planet's magnetic field overwhelms the sun's.

Sunspot cycle: A new beginning

Mottling the sun like dark blemishes, sunspots are associated with strong magnetic fields and huge flares. Last month's discovery of three sunspots with unusual characteristics heralds the beginning of a new cycle for these mysterious objects.

Sunspots typically last for only a few days, but the rate at which the sun generates them rises and falls through roughly an 11-year period. At the beginning of each new cycle, these solar blemishes emerge at a relatively high latitude—about 30°—and have the opposite magnetic polarity of sunspots from the last cycle.

A sunspot detected Aug. 12 at the Big Bear Solar Observatory in Big Bear City, Calif., exhibited both of these telltale features, prompting observatory director Harold Zirin to announce that a new cycle had started. With only one such sunspot observed, some researchers were dubious, he notes. But the detection of two other sunspots the following week clinched the interpretation, he says.

One of the spots occurred near the equator, and researchers might have classified it as a leftover from the previous cycle. But the reversal of its magnetic field suggests that it, too, belongs to the new cycle, Zirin says. He notes that solar activity usually peaks 4 to 5 years after the beginning of a cycle.

Behavior

Genetically tailing fearful mice

Scientists say they have taken the first step toward locating genes that contribute significantly to the fearfulness displayed by some laboratory mice in novel settings. This line of research may eventually lead to the identification of genes that, to varying degrees, underlie human susceptibility to anxiety, assert Jonathan Flint, a behavioral geneticist at John Radcliffe Hospital in Oxford, England, and his colleagues.

Previous research has established that rats and mice ushered into unfamiliar surroundings—typically, a brightly lit, open arena—exhibit a variety of responses, ranging from spirited exploration to a combination of barely budging while defecating copiously. Scientists refer to the latter reaction as "emotionality." It occurs consistently enough in the same individual rodents to be considered a psychological trait, according to Flint's group.

Flint and his coworkers studied DNA obtained from 394 laboratory mice. Half had displayed high levels of emotionality in experimental settings, while the remainder ambled with little or no fear through the same setups. The researchers used special enzymes to snip out a total of 84 segments from the DNA of each mouse. Three of those segments—each located on a different chromosome—featured chemical arrangements that occurred much more frequently in animals exhibiting high emotionality, they report in the Sept. 8 SCIENCE.

Genes that at least partly contribute to rodent emotionality apparently lie within the trio of tagged DNA sections, the researchers contend. It remains unclear whether such genes will offer any clues to the genetic roots of human anxiety. However, different rodent species probably bear corresponding genes that promote emotionality, the scientists hold.

Future studies that corner genes making a range of contributions to human psychological traits may help to resolve debates about the nature of common psychiatric disorders, they add. For instance, genetic discoveries may help clarify the extent to which anxiety disorders overlap with depression.

Where objects go in the brain

The sight of familiar faces and objects hardly provokes a mental sweat, but it gets the brain pumping. Consider a patch of tissue at the back of the brain's outer layer, or cortex. This region may serve as a generic object detector that alerts other parts of the visual system to retrieve names and functions of various items, according to a report in the Aug. 29 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Depictions of blood flow in living brains, generated through functional magnetic resonance imaging, indicate that this cortical region certifies an observed entity as an object of some type. Other parts of the visual system then specify the object as a particular friend's face, a lamp, or whatever is deemed appropriate, argues a team of neuroscientists directed by Roger B.H. Tootell of Harvard Medical School in Boston.

The researchers contrasted cortical blood flow in 16 healthy adults during two trials. Participants viewed pictures of a variety of objects in one trial and pictures of textured and geometric patterns in the other. Presentation of objects, including faces of famous people, common plants and animals, and unfamiliar abstract sculptures, uniquely activated a brain area Tootell's team calls the lateral occipital complex (LO).

LO activity also jumped sharply when volunteers looked at a computer screen showing pictures of faces that were digitally broken into a number of large blocks and then blurred slightly. Prior research has found that comparable blurring of picture blocks boosts their recognizability as parts of a single object.

"These results are evidence for an intermediate link in the chain of processing stages leading to object recognition in human visual cortex," the investigators conclude.