Astronomy

Galileo spies Io's light show

Eerie flashes of blue, green, and red loom on the horizon of a tiny body 600 million kilometers from Earth. Images from the Galileo spacecraft reveal that Jupiter's moon Io makes a spectacle of itself in more ways than one: The most volcanically active body in the solar system also generates the most dazzling auroras.

Like auroras on Earth, those on Io are produced when electrons, directed by a strong magnetic field, crash into gases in the moon's atmosphere. Jupiter's intense magnetic field provides the driving force, as well as maintaining a doughnut-shaped reservoir of charged particles that bathe Io.

In the Aug. 6 SCIENCE, Paul E. Geissler of the University of Arizona in Tucson and his colleagues analyze the auroral images.

A bright-blue glow, centered on the equator and extending several hundred kilometers above the moon, emanates from volcanic plumes. This glow probably arises from electrons colliding with sulfur dioxide gas spewed by the volcanoes. A weaker, red glow, which is brightest near the north pole, may stem from electrons striking oxygen atoms. A faint green glow, concentrated on the moon's night side, may be due to electrons slamming into sodium atoms.

Galileo viewed the auroras several times when Io was in Jupiter's shadow. The red and green glows dimmed during these eclipses. In the absence of sunlight, atmospheric gases freeze onto the moon's surface and electrons have fewer particles with which to collide, Geissler's team explains.

To the team's surprise, however, the blue glow intensified. The group traces this effect to the large electric current that flows from Io to Jupiter. Jupiter's magnetic field, rotating with the planet, generates the current as it sweeps past the moon.

This giant circuit normally passes through Io's atmosphere, but an eclipse may modify that route, the team theorizes. As the darkened atmosphere thins and becomes a poorer electrical conductor, the circuit may connect instead through the moon's interior, passing through volcanic plumes and enhancing their bluish glow.

The Saturn-bound Cassini craft may snap images of the auroras when it passes by Jupiter in late 2000 and early 2001. *—R.C.*

Icy cracks may betray Europan ocean

Circumstantial evidence that Jupiter's moon Europa harbors a subterranean ocean—a possible haven for extraterrestrial life—continues to mount.

The latest findings come from an analysis of features first seen by the Voyager spacecraft in 1979. Near Europa's south pole, the craft recorded scalloped lines that continue for hundreds of kilometers. The Galileo craft, now touring Jupiter, has recorded the same scalloped pattern over Europa's entire surface.

According to a model developed by Gregory V. Hoppa, Paul E. Geissler, and their colleagues at the University of Arizona in Tucson, the arcs are fractures generated when Europa's icy surface flexes in response to the rise and fall of tides in the underground ocean. As it follows an elliptical, 3.5-day orbit around Jupiter, Europa changes its distance from the planet and thus its tidal pull. One new arc in the scalloped pattern appears to have formed during each 3.5-day interval, the team notes in the Sept. 17 SCIENCE.

Although the model only suggests that Europa once had an ocean, the moon's nearly crater-free, youthful facade indicates that the arcs seen by Galileo were generated no earlier than 100 million years ago. "It stretches the imagination to assume that the subsurface had been liquid [then] and froze up so recently," says Geissler.

"This adds significantly to the evidence for an ocean under the present, relatively thin ice crust," says William K. Hartmann of the Planetary Science Institute in Tucson. Confirmation could come with the 2003 launch of Europa Orbiter, which will use radar to measure the thickness of the moon's icy crust and may determine whether liquid water exists below. *—R.C.*

Biology

Unemployed bees get job taking heat

In a previously unrecognized display of insect heroics, honeybees will cluster on a hot spot on the wall of their hives, forming a living shield to keep the next generation from cooking.

"Thermoregulation is a big deal," explains Philip T. Starks of the University of California, Berkeley. With a lot of fussing, honeybees manage to keep their brood comb at 34° to 36°C year round, despite the ups and downs of outdoor temperatures. Researchers knew that bees prevent overheating by fanning their wings, and sometimes by spreading water and then wafting air across wet spots for evaporative cooling.

Now, Starks and Cornell University's David C. Gilley have discovered a new temperature trick. The researchers put heating pads against the outside of various sectors of eight laboratory beehives. When temperatures rose near the honeycombs, bee numbers almost quadrupled on the overheating wall.

When the researchers applied heat near the precious combs holding the youngsters, bees on nearby walls increased almost sevenfold, they report in the September NATURWISSENSCHAFTEN. "The brood comb contains the hive's future so it's no wonder the adults protect it," Starks says.

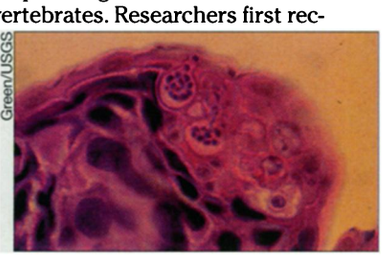
The bee shields did absorb excess heat, Starks says. Colonies buzzing with lots of bees managed to keep the percentage temperature rise in their brood comb down to less than half what it was in depopulated colonies that couldn't muster much of a living shield.

Starks doesn't think that heat protection is diverting bees from other jobs so much as rallying taskless bees. Despite their proverbial busyness, he says, only about half the bees in a hive are obviously working at any one time. As he puts it, "Heat-shielding also provides a potential function for the so-called unemployed bees." *—S.M.*

Killer skin fungus nails boreal toads

The chytrid skin fungus, which made headlines last year after killing off amphibians around the world, has now turned up in boreal toads from Clear Creek County, west of Denver.

This outbreak marks the fungus' second documented fatal attack on wild U.S. amphibians. Common in soil, many species of chytrids had been known to break down dead insects and cause crop diseases. Not until 1989 did pathologists realize that one of these fungi causes disease in vertebrates. Researchers first recognized the fungus as the agent behind puzzling amphibian deaths in zoos. Last summer, several teams reported chytrid infections in amphibians in remote areas of Australia and Central America. Researchers next found the characteristic skin thickenings and spherical fungal bodies in dying leopard frogs in Arizona (SN: 7/4/98, p. 7).



Toad tissue shows two chytrid fungi with dots of zoospores inside.

More news may break soon, however, hints D. Earl Green of the U.S. Geological Survey's National Wildlife Health Center in Madison, Wis., the veterinary pathologist who diagnosed the Colorado outbreak. He recently completed an article analyzing amphibian deaths in Yosemite National Park in California.

At the Colorado study site, a monitoring team found dead and dying boreal toads in May, and Green's microscopic exam revealed chytrid infection. The number of boreal toads, once common in Colorado, northern New Mexico, and southern Wyoming, has dwindled alarmingly during the past 20 years. Whether the fungus started the population crash or just appeared in its twilight stages, Green declines to guess. "There's just no data," he laments. *—S.M.*