The new view of gibbon family life is emerging from a fresh crop of long-term studies. For example, Bartlett, who presented his findings at the meeting, tracked two groups of white-handed gibbons (*Hylobates lar*) intensively for a year in the Khao Yai National Park in a seasonal tropical forest north of Bangkok, Thailand. These apes have been studied off and on for 15 years by ecologist Warren Brockelman at Mahidol University in Bangkok and his colleagues, so they are accustomed to humans; Bartlett thinks that this allowed the animals to relax and exhibit social behaviors not seen before.

Researchers had thought that gibbon families, although stable, were always territorial and hostile to neighbors, but the Thai gibbon families socialized with one another. In fact, one group spent 25% of its encounters with three other groups in "affiliative," or friendly, encounters, where the juveniles played and groomed each other. Most surprising, one adult male groomed and played with juveniles from another group. When Bartlett checked the long-term records on the groups, he realized that the friendly adult was an uncle of the neighboring juveniles, implying that the male had switched groups. "Their social relationships are a lot more complex than we'd assumed," says Bartlett. "They are migrating into groups that are not very far away, and there's a complex awareness of who is in the neighborhood."

This sociability also extended to mating habits. One young male left his group to move in with neighbors, where he began singing the characteristic mating duet with the adult female; he eventually supplanted her older male companion. This backs up work by primatologist Ryne Palombit of the University of Pennsylvania, Philadelphia, who recently studied gibbons at the Ketambe Research Station in Sumatra, Indonesia, for 6 years. He saw one female leave her group to join a newly widowed male, where she stayed for several months, mating with him and several other males before returning to her original mate. "All the textbooks say you have a male and female who are monogamous," says Palombit. "What we saw is that there may be a male and female, his brother, her sister, her daughter, his son. It's just very complicated, and the rigid nuclear family model is insufficient."

Instead, a new model is emerging of a "non-nuclear" family, where mates sometimes come and go, and the offspring from different unions grow up together. At least for gibbons, it seems that monogamy can be a lot more interesting than humans ever imagined.

–Ann Gibbons

ASTRONOMY

Last Hurrah for an Infrared Satellite

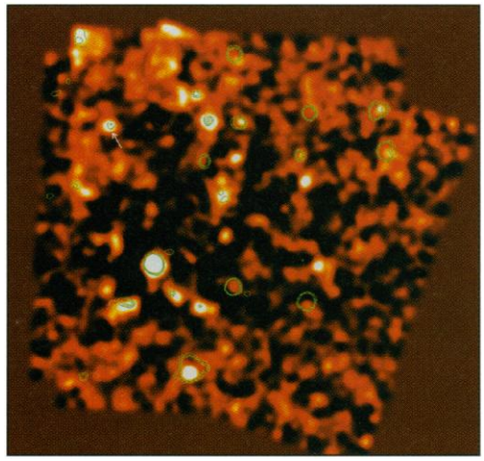
When the temperature climbs beyond 2 degrees above absolute zero, it gets uncomfortably warm for an infrared satellite. The European Infrared Space Observatory (ISO) reached that point early last month after it finally ran out of coolant and had to quit its measurements of the feeble heat radiation from the rest of the universe. Sometime about mid-May, engineers at the European Space Agency's (ESA's) ground station in Villafranca, near Madrid, will shut it down for good.

"This is a time for celebration, not sorrow," says ESA science director Roger Bonnet. ISO lived for 10 months beyond its expected 18-month lifetime, collected more than 26,000 observations from Earth's astronomical backyard to the far reaches of the universe, and made several important findings during its final days. "It's been a spectacular success," says Reinhard Genzel of the Max Planck Institute for Extraterrestrial Physics in Garching, Germany, who chairs ESA's astronomy working group.

Cooled by over 2000 liters of superfluid helium, ISO's sensitive detectors were able to study the infrared glow of "the icy, dusty, rocky, and molecular universe," as Bonnet puts it, as opposed to the hot, gaseous universe that emits visible light. In just a few of its research highlights, ISO studied colliding galaxies, discovered crystalline silicate grains in protoplanetary dust disks, and found huge quantities of interstellar water vapor in the Orion Nebula (*Science*, 17 April, p. 378).

As one of its last feats, ISO picked up the infrared signature of water in the chilly atmosphere of Titan, the largest moon of Saturn. Although it's a minor constituent of the nitrogen-rich atmosphere, water vapor "makes the already complex story of the atmosphere of Titan ... a little more enticing," says Carolyn Porco of the Lunar and Planetary Laboratory of the University of Arizona, Tucson. The finding, by a team headed by Athena Coustenis of the Paris Observatory and Alberto Salama of the ISO Science Operations Center at Villafranca, implies that water is being delivered into Titan's atmosphere from some outside source, Genzel said at a press meeting in London last month.

"The chances are next to nil for the ISO-observed water vapor to be derived from the [extremely cold] surface of Titan," agrees Porco. "A good candidate is cometary impact. But it may not be the whole story." Porco, who is principal investigator for the camera on board the Cassini spacecraft bound for Saturn and Titan, thinks the icy rings of Saturn might also be shedding water into Titan's atmosphere, "though I don't think anyone has given this serious consideration."



ESA

Distant fires. ISO reveals infrared-bright galaxies at two different wavelengths in a site to be probed by the Hubble Space Telescope; arrow indicates a previously unknown galaxy.

Farther afield, ISO also took a long look at a small patch of sky called the Hubble Deep Field South. In late October, the Hubble Space Telescope will observe this tiny region continuously for many days to spy on faint galaxies in the distant universe, repeating an observation it made more than 2 years ago in the northern sky. ISO's detailed image gives a preview of what Hubble may see. The image swarms with galaxies that are surprisingly bright in the infrared, just as an earlier ISO image of Hubble Deep Field North had shown. The galaxies must be ablaze with newborn stars, which are hidden from optical detectors behind shrouds of dust. What's more, says team member Sebastian Oliver of Imperial College London, "we've detected at least one galaxy with no known visible counterpart."

Even after the temperature of ISO's detectors became too high for most of its instruments to operate, the Short Wave Spectrometer, built by the Groningen laboratory of the Space Research Organization Netherlands, soldiered on into the second half of April, collecting data on "standard stars" to extend an existing star classification scheme into the infrared. And ISO's death will mean only a pause for space-based infrared astronomy. Future orbiting observatories, like NASA's Space Infrared Telescope Facility and ESA's Far Infrared Space Telescope, scheduled for launch in 2001 and 2005 respectively, will extend ISO's harvest of observations, which now fill nearly 1000 CD-ROMs.

–Govert Schilling

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.