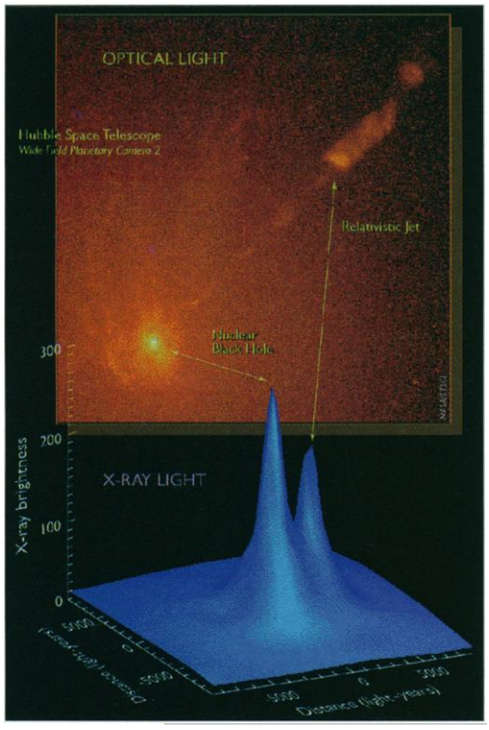
ASTRONOMY

Starving Black Holes Sound an SOS

An x-ray satellite may have heard the whimpers of dying quasars. The Japanese Advanced Satellite for Cosmology and Astrophysics (ASCA) has picked up feeble high-energy x-rays from six old, nearby galaxies —the distress signals of supermassive black holes starving to death. Or so say American and British astronomers who presented their results last week at the meeting of the High Energy Astrophysics Division of the American Astronomical Society in Charleston, South Carolina.



Cry of the heart. X-rays from the core of the galaxy M87 may reveal a black hole feeding on a trickle of gas.

CREDITS: (TOP) NASA; (BOTTOM) ASCA

The results suggest that the giant black holes powering quasars, brilliant galaxylike objects in the early universe, did not shut down completely as their food supply—interstellar gas—dwindled. Instead, say Tiziana Di Matteo of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, and Steven Allen and Andy Fabian of the Institute of Astronomy in Cambridge, U.K., such black holes continue to emit a whisper of x-rays, generated by a slow trickle of very hot gas. Some other researchers aren't convinced by this picture, which the astronomers also describe in a paper submitted to the *Monthly Notices of the Royal Astronomical Society*. But if it's correct, it implies that part of a mysterious glow of x-rays that fills the universe might come from starving quasars.

Astronomers already suspected that the giant elliptical galaxies where ASCA picked up the x-ray signals harbor black holes millions or billions of times more massive than the sun. In five of the six, says Fabian, stars and gas whip around the center at high speeds, apparently in the grip of a powerful gravitational field. But these black holes had seemed quiescent, like those thought to sleep at the centers of our own galaxy and others. The black holes may once have produced the prodigious radio and x-ray emissions that emerge from active galactic nuclei and quasars, but they long ago fell silent.

Or so astronomers thought. Di Matteo, Allen, and Fabian say that the small quantities of high-energy x-rays that ASCA picked up are just what you would expect of a quasar still being fed by a trickle of gas. Instead of forming the flat, dense disk of infalling material thought to surround the black hole in a quasar or active galaxy, the meager infall should form a bloated, tenuous disk, or torus. According to theoretical models, the ionized hydrogen in such a low-density disk would grow very hot, because hydrogen nuclei, or protons, radiate energy slowly. In a denser disk they can transfer energy to electrons, which radiate millions of times more efficiently, but in a rarefied disk, collisions between the protons and electrons would be infrequent. The superheated gas would slowly leak very high-energy x-rays.

"It's a plausible model," says Bram Achterberg of Utrecht University in the Netherlands, "although it's not completely clear that such hot, thick disks can remain dynamically stable over long periods of time." Julian Krolik of Johns Hopkins University in Baltimore also questions the assumption that heat would be bottled up in the protons. "Laboratory experiments indicate that there are many more mechanisms [for electrons and protons] to exchange energy" than the models allow, he says.

Fabian concedes that he and his colleagues also can't be sure the faint x-rays really are coming from the cores of the elliptical galaxies; ASCA's positional accuracy of half an arc minute is simply not high enough. "There's a lot of galaxy in half an arc minute," he says. But he says that NASA's Chandra X-ray Observatory, due to be launched later this year, will "without doubt deny or confirm our model."

If it does hold up, such faint x-ray signals could support astronomers' suspicions that droves of supermassive black holes lurk in nearby galaxies. The murmurs of starving

ScienceScope

Comet Tale A nifty NASA plan to land a probe on a comet's head appears to be back on track after a budget scare. Researchers at the Jet Propulsion Laboratory in Pasadena, California, want to send the Champollion spacecraft to a 2006 rendezvous with comet Tempel 1. But earlier this month, the $158 million project seemed imperiled by budget strains caused by unplanned expenses in other science programs, including a $76 million emergency repair mission to the Hubble Space Telescope (*Science*, 19 March, p. 1827) and mounting expenses related to the delayed Chandra X-ray Observatory (above). Worried that his dream child would be sentenced to death, project scientist Paul Weissman earlier this month sent a letter to colleagues appealing for help.

This week, however, Weissman said the scare turned out to be much ado about nothing. After presenting a revised design to NASA brass, who were worried that the project was over budget, the cancellation demon is "back in the bag," he says. However, sources say agency officials are still looking for savings elsewhere in the space science portfolio—a threat that has some researchers looking over their shoulders.

AIDS in Spain Stepping up its fight against AIDS, Spain—the nation with Europe's highest per capita AIDS rate—last week created a new fund to support research into the disease. Five international drug companies have teamed with the Spanish government to establish the Foundation for Research and Prevention of AIDS, which will spend $3 million a year on peer-reviewed basic research, clinical trials, and public health studies.

The foundation starts with a $600,000 kitty, endowed equally by the Ministry of Health and the five companies: Abbott Laboratories, Bristol-Myers Squibb, Glaxo Wellcome, Merck Sharp & Dohme, and Roche. Each firm will chip in another $670,000 a year, starting next year. About 120,000 Spaniards were infected with HIV in 1998; another 53,000 have AIDS. AIDS researcher Josep Mallolas of the University of Barcelona Hospital Clinic calls the new foundation "very good news—not only for AIDS research but also for [Spain's] biomedical sciences in general."

Contributors: David Malakoff, Govert Schilling, Xavier Bosch

black holes could also be a major part of the universe's diffuse x-ray background, say Di Matteo and Allen, although Fabian is not so sure. "Here I disagree with my co-authors," he says, noting that most astronomers think very distant active galaxies are the source of the pervasive x-rays. "That's the model I believe in for 6 days of the week."

–GOVERT SCHILLING

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

CONSERVATION BIOLOGY

Study Sounds Alarm on Yellowstone Grizzlies

Drive through Yellowstone National Park on a late spring day, and there's a good chance you'll see some of its thriving black bears—a young adult foraging near a stream, or a mother with cubs clambering up a hill. But odds are you won't spot a grizzly: Only a few hundred of these elusive animals roam the Yellowstone ecosystem. Just as elusive, however, is whether the grizzly is prospering out of the spotlight. The Interior Department, which runs the park, thinks so, and in June intends to release a strategy for managing the bear after its eventual removal from the threatened species list. Others disagree and are emboldened by a new study suggesting the Yellowstone grizzly is not yet out of the woods and that the government's victory declaration may be premature.

Bad news, bear? Scientists disagree over whether Yellowstone's grizzlies remain imperiled.

Wildlife biologists have dueled for years over how many grizzlies inhabit Yellowstone. An accurate census of the reclusive bears is out of the question, so both sides rely in part on estimates of the population's growth rate to determine whether the grizzly can survive without federal protection. Much of the rancor stems from differing interpretations of data on grizzlies tracked by radio or spotted year-round. Using a new model of population dynamics based on field data, ecological modeler Craig Pease of Vermont Law School and David Mattson, a U.S. Geological Survey (USGS) grizzly biologist, estimate that Yellowstone grizzly numbers grew only about 1% a year from 1975 to 1995—much lower than the 5% annual rise over the last decade claimed by Interior. Their report, in this month's issue of *Ecology*, also portends harder times for the grizzlies, thanks to poor yields of whitebark pine seeds, a favorite food. Some experts applaud the work. "I'm absolutely convinced [they] have the right answer," says University of California, Santa Cruz, population biologist Dan Doak.

Interior officials beg to differ. "The population's been going up for some time," says Chris Servheen of Interior's U.S. Fish and Wildlife Service, who's coordinating an evolving agency plan for managing the grizzly after delisting. Still, he says, to help determine whether the population is growing sustainably, Interior has asked a panel of The Wildlife Society—primarily field biologists and resource managers—to review grizzly data and report back in the next few months.

In the 1800s, up to 100,000 grizzlies roamed the lower 48 United States, scientists estimate; less than 1000, it appears, were left by 1975. For decades, rangers tolerated bears feeding at garbage pits. Enlightened managers stopped these practices in the early 1970s, hoping to reduce maulings and allow the bears to lead a more natural life. But scores of bears, unable to break the habit of looking for handouts or snatching sheep, were killed. In 1975, the government put the remaining grizzlies on the threatened list.

Pease and Mattson began examining grizzly numbers around 1992, after obtaining Interior monitoring data on 202 radio-collared bears it had tracked since 1975. The duo folded these data into a model of births and deaths that takes into account factors—such as age, sex, and whitebark pine yield—that influence bear survival. They also corrected for a problem they claim was overlooked in previous studies: Bears collared in the backwoods for research are less likely to pose a problem to humans and be shot; thus, any population growth estimate based only on data for these bears is likely to be inflated, Pease says.

Some scientists dispute this analysis. The model is "way too complex for the available data," says ecologist Mark Boyce of the University of Wisconsin, Stevens Point, who coauthored studies finding a 5% rise. "There are so many different sources that point to the population increasing, it's almost incomprehensible that these guys could claim that the bears haven't increased." For example, counts of females with new cubs in 1996 were the highest since 1959. And grizzlies, which stake out large territories, appear to be pushing southward and eastward. "Bears are occupying habitat where they haven't been for the last 40 or 50 years," says Servheen.

Pease dismisses the cub counts as "biased and ad hoc." He speculates that bears may be straying farther from the park because a scarcity of whitebark pine is forcing them to forage at lower elevations. In addition, nobody has explored whether the 1988 fires forced bears to shift their ranges or made them otherwise easier to spot, grizzly modeling pioneer Mark Shaffer of Defenders of Wildlife noted in *Science* last week (p. 433).

Even if optimistic population estimates are accurate, the grizzlies may face a hard road. A disease called blister rust is devastating the whitebark pine, Pease and Mattson note. Other grizzly food sources are declining, too. Cutthroat trout, which the bears fish out of streams during spawning, are getting eaten up by lake trout, and park managers are shooting bison and collecting the carcasses (instead of leaving them for bears) to avoid the spread of brucellosis to cattle. "The number of bears is unlikely to grow unless we can close roads and restrict hunting and grazing," says Pease. Removing the grizzly from the endangered list at this time, Boyce adds, "doesn't make a lot of sense."

Servheen says Interior is forging ahead with its management plan but is keeping an open mind on the delisting, pending The Wildlife Society's report. In the meantime, he says, a USGS tracking study could yield a better ballpark number of grizzlies by summer. "If the status is good, we should celebrate that and move on to other problems," says Shaffer. "If it hasn't recovered, we need to get back to work."

–JOCELYN KAISER

PARTICLE PHYSICS

Italy's KLOE Sets Sights on CP Violation

NAPLES, ITALY—The titans of the particle physics world, the CERN laboratory near Geneva and Fermilab near Chicago, are racing to confirm that matter and antimatter are not always completely equivalent—in technical parlance, they are searching for violation of CP symmetry. But at Frascati, south of Rome, a more modest outfit hopes to rob them of that prize. Last week, this upstart machine, called KLOE, recorded its first real data. KLOE is a new detector purpose-built to look for CP violation in particles produced by DAFNE, Italy's new electron-positron collider at the National Institute for Nuclear Physics (INFN).

In contrast to its bigger particle-smashing cousins, INFN aims to make a virtue of its low-energy status by producing events that are cleaner and recording them more completely. To achieve that, KLOE has the world's largest drift chamber—where the

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