New view of quasars sheds light on origin

Quasars, the intense searchlights that lie at the hearts of some galaxies, rank among the brightest objects in the universe. Evidence reported this week lends support to the notion that the darkest bodies in the cosmos power these brilliant emissions.

Viewed through Earth's atmosphere, the blinding light of a quasar appears as a fuzzy blob, obscuring its much fainter galactic living quarters. The sharp eye of the Hubble Space Telescope, however, can pick out the cores of galaxies that quasars call home. Two independent Hubble surveys now reveal that of 35 observed galaxies that host quasars, about half appear to have been ripped apart, to have suffered recent collisions, or to be about to merge with a nearby galaxy.

These violent scenes suggest that many quasars light up when a collision or merger creates a fresh supply of gas and dust, reviving a dormant black hole at the center of a galaxy. The black hole embarks on a feeding frenzy, sucking in the new material. As the gas and dust spiral in, they radiate away much of their energy, generating the quasar's fierce emissions.

Until the Hubble mug shots, astronomers had little evidence for this widely held view about the origin of quasars, says Hubble astronomer Michael Disney of the University of Wales in Cardiff. Disney adds that this scenario could explain why quasars seem to have been more common in the past than they are today.

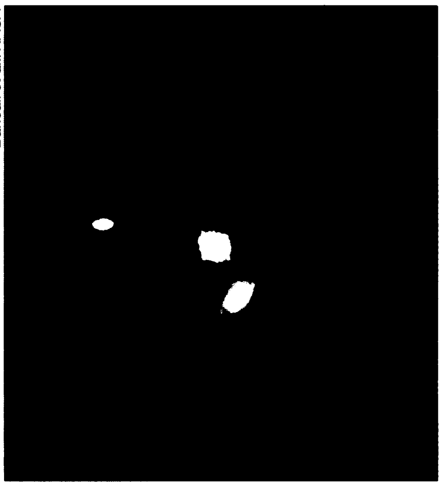
The universe was more compact in the past because less time had elapsed since the Big Bang triggered its expansion, he notes. As a result, collisions and mergers between galaxies were more frequent, and the chances of rejuvenating a dormant black hole were considerably higher. To sustain a quasar, a black hole must continually refuel. This suggests that quasars have short lives—perhaps 100 million years—and that many galaxies today harbor quiescent black holes, Disney says.

Some nearby galaxies whose cores are bright, but less luminous than quasars, could contain the embers of quasars that ran out of fuel, comments Harley A. Thronson of NASA headquarters in Washington, D.C.

Using Hubble's wide-field and planetary camera, Disney and his European collaborators found that 11 of the 20 host galaxies they observed show evidence of having been disrupted or being about to collide with another galaxy. Similarly, a team led by John N. Bahcall of the Institute for Advanced Study in Princeton, N.J., used the camera to examine another 15 galaxies that harbor quasars. The researchers found that nearly half show signs of recent disturbance. Disney and Bahcall reported their findings at a press briefing in Washington, D.C.

Bahcall says the images show that a surprising variety of galaxies, some of which appear to be completely isolated, host quasars. Disney counters that at least some of these seemingly isolated bodies may have eaten a galaxy too small for Hubble to discern. Bruce H. Margon of the University of Washington in Seattle estimates that a galactic black hole needs to devour only a few times the mass of the sun in gas and dust each year to fuel a quasar. — *R. Cowen*

Bahcall *et al.*/NASA



A galaxy harboring the quasar PSR 1012+008 (top) merges with a neighbor.

Language mastery goes native in the brain

A core network of structures in the left hemisphere of the brain underwrites the understanding of a native language, whether it's spoken or signed, a new investigation finds. The data also suggest that initial experience with either English or sign language exerts specific effects on cerebral language organization.

Surprisingly, sign language comprehension is accompanied by substantial neuronal activity in parts of both the right and left hemispheres of native signers, reports psychologist David P. Corina of the University of Washington in Seattle.

"Our data imply that specialized language systems are established within the left hemisphere with the acquisition of a fully grammatical, natural language, even if it is not a spoken language," Corina contends. "But the right hemisphere is also involved in processing sign language."

Corina and another participant in the international project, Daphne Bavelier of Georgetown University Medical Center in Washington, D.C., presented the findings last week at the annual meeting of the Society for Neuroscience in Washington, D.C.

Corina's group used functional magnetic resonance imaging to compare cerebral blood flow in volunteers as they read English sentences and random strings of consonants and as they watched the presentation of sentences and nonsense signs in American Sign Language. Elevated blood flow provides an indirect measure of surges in neural activity.

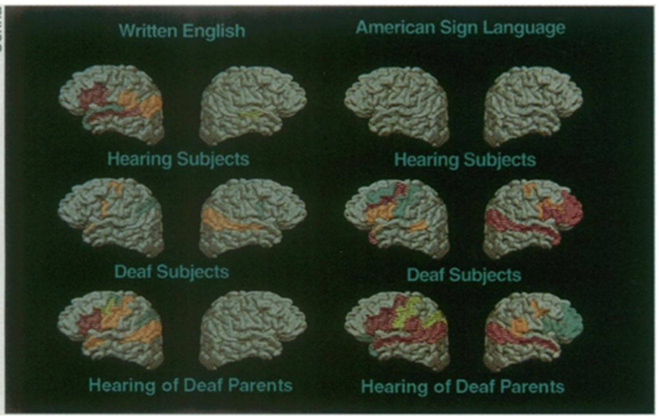
Participants consisted of eight hearing, native English speakers who did not know sign language, 16 native signers who had been deaf from birth but had learned English as young adults, and 13 hearing adults who were born to deaf parents and learned American Sign Language before acquiring English.

When reading English, both native speakers and hearing offspring of deaf parents displayed increased activity largely in left brain areas previously linked to language. Deaf signers exhibited patchy increases on both sides of the brain.

When interpreting signed sentences, deaf signers and hearing offspring of deaf parents experienced left brain activity boosts like those in native speakers reading English, as well as increased blood flow in the right brain. The activity in the right side reflects linguistic processing rather than simply the spatial analysis of signs, Bavelier argues.

"These data show that spoken language is part of a larger linguistic system in the brain," notes psychologist Ursula Bellugi of the Salk Institute in La Jolla, Calif. "The right hemisphere's role in processing sign language will need to be explained in future work." — *B. Bower*

Corina



Brain images depict average blood flow in each group during linguistic tasks, with greatest activity shown in red.