Nearest quasar: An explosive birth

Quasar, Quasar, burning bright, In the dark and starry night, Now you are, we seem to see, An exploding galaxy.

During more than a decade of observation, astrophysicists have wondered what quasars are. On the whole they have made slow progress with the question. Quasars look like stars, but they radiate as much energy as galaxies; therefore much of the hypothesizing about them has tried to link them to galaxies.

One suggestion is that quasars are evolutionarily connected to galaxies: that they represent a time in the development of a galaxy when it is all center—before its outlying parts have developed. A similar view sees a quasar as a galactic center whose outlying parts for some reason never developed but which is not necessarily evolving into a more usual type of galaxy. Finally there is a view that quasars are violent events, explosions, in the centers of already developed galaxies.

This last hypothesis explains the starlike appearance of quasars by postulating that the brightness of the center washes out the light from the surrounding galaxy. Astronomers who support this hypothesis have in recent years shown photographs in which the images of some quasars were surrounded by fuzzy nebulosities that might be galaxies, but no one up to now has shown spectra from these nebulosities that prove the presence of stars.

Now there is such evidence. J. B. Oke and James Gunn of the Hale Observatories have obtained spectra from the quasarlike object BL Lacertae that are characteristic of old stars in spherical galaxies.

For years BL Lacertae has been listed in catalogs as a variable star. In the last few years it has been clear that it is not one, major evidence being the discovery of radio emission from it. Its radio and light outputs vary in a manner suggestive of a quasar. Another curious point is that even with the Hale Observatories' 200-inch telescope no line spectrum could be obtained from the central brightness of BL Lacertae.

A research engineer at the observatories, Earle Emery, designed and built an obscuring disk which was mounted in the aperture of the telescope so as to block out the central luminosity of the object but not the fuzzy ring around it. Now that light from this fuzzy ring has been spectroscopically analyzed, the stellar spectra have been obtained. It is the culmination of four years' work on BL Lacertae by Oke and Gunn.

The observers explain the absence of a line spectrum from the center of BL Lacertae—most quasars show line spectra—by saying that the lines in other quasars' spectra are contributed by gas clouds surrounding the quasar. There is very little gas in spherical galaxies, so the effects of gas should not show up in BL Lacertae.

Spectra indicate that the object is about a billion light-years away. This makes it the nearest known quasar. Oke and Gunn point out that this nearness and the low brilliance of the central object compared to most quasars was what enabled them to make the spectroscopic observation. Without that fortuitous coincidence it would not have been possible. The variability of the object's light and direct measurement with radio telescopes indicate that the quasar in BL Lacertae is less than one light-year across. This is very small compared to the diameter of its galaxy, which is more than 100,000 light-years.

If quasars are indeed explosions in the centers of galaxies, the occurrence of one in a galaxy as old as a spherical raises the question whether a quasar can happen more than once in the life of a given galaxy. Apparently yes, but, says Oke: "Maarten Schmidt [of Caltech and the Hale Observatories] has shown that the further you look into the past, the greater the density of quasars. Since galaxies were young then, it is tempting to suppose that galaxies become quasars much more often when they are young. It may be a pretty rare event for old galaxies."

The next question is: What causes such explosions? That is the $64,000 question for which there is yet no answer. It will take more study of galactic centers, both normal and quasar, to find out if it can be found out. □

Babies: More aware than we think

Psychologists used to believe that up to six weeks of age, a baby cannot see in any real sense of the word. Then in the early 1960's, Robert Fantz of Western Reserve University demonstrated that babies can indeed distinguish between two-dimensional patterns in the first few days of life. This discovery led to a flurry of research activity, and now psychologists know that most one- to two-week-old children can also respond to shapes, angles, edges and, perhaps from birth, experience a three-dimensional world. (Babies will grasp for a three-dimensional object but not for a two-dimensional photograph of the object.)

Now research by behavioral scientist Genevieve Carpenter of St. Mary's Hospital in London and colleagues at the Boston University Medical School sheds new light on infant perceptional abilities. In a series of laboratory experiments, Carpenter found that babies learn to recognize voices and faces during the first two weeks of life.

Past experiments dealt with patterns, photographs and solid objects. Carpenter felt that familiar objects—objects out of an infant's everyday experience—might elicit more sophisticated responses than abstract designs. Mother's face is probably the most familiar "object" in an infant's environment. Carpenter placed mother's face (her body was shielded from the infant's view), a mannikin's head and a kitchen collander (painted flesh colored) in front of a number of week-old Negroid females. Neither mother nor the forms moved before the babies except in a horizontal direction. (Female infants were chosen over males because on the average they respond to perceptional tasks differently, and have a different rate of development, with researchers' ahead.) To the researchers' surprise, the infants paid least attention to mother.

"The lesser attention to the mother was neither passive uninterest nor active search for other information," Carpenter comments in the March 31 NEW SCIENTIST. "Infants would tense as they averted their gaze, appearing to keep the target in peripheral view. From this position, they would frequently take furtive glances. Sometimes they would turn 90 degrees and cry."

She repeated the experiment to find whether it was possible that the darker Negroid face provided less distinct contrasts and contours, and therefore, was more difficult for the child to fix her attention upon. This time, Caucasian babies and mothers, and two mannikins (Negroid and Caucasian) were employed. But again, the infants paid less attention to their mothers. Carpenter deduced that the brightness of the stimulus was not an influence on the children's behavior. Carpenter adds: "When the faces moved they attracted more attention. But even when faces moved, mother was looked at least. Both Caucasian and Negroid models received more attention than mother."

Her third experiment revealed that the infants looked least at mother because she was in an unfamiliar context. Normally, mother's face moves animatedly and is accompanied by talking

and touching. When the mother appears voiceless and immobile as in Carpenter's first two experiments, the situation does not conform to the infant's everyday experience. For when Carpenter placed before each baby the mother alone, mother's face plus mother's voice, mother's face with a stranger's voice and vice versa, the voiceless mothers received more attention than either strangers or the mother with a stranger's voice.

"Clearly this selected group of infants were capable of detecting differences between the two live female faces during the earliest weeks of life," Carpenter says. "Whatever cues the infants were using—salient features or the whole configuration—they were sufficient to allow discrimination in the first fixation. . . . Further, it appears that more than one category may be used in classifying information. It may also be that infants do not have to build up their picture of the world from scratch, but see configurations which become elaborated and refined in the course of development. More sophisticated information processing capabilities appear to be operating in the newborn's interaction with its environment than we had thought possible." □

Energy: The long and the short of it

The preliminary report of the long-awaited Energy Policy Project of the Ford Foundation has now been issued. The study, produced under the direction of former Presidential energy advisor S. David Freeman, contends the United States has considerable flexibility in choosing long-range energy sources and in making trade-offs between development and environmental protection. But it is not so optimistic over the possibility of finding solutions to immediate energy problems that would not harm the environment or cause undue hardship to some segments of the population.

The report examines several of the most often cited options for meeting the current crisis and finds each wanting. Coal, for example, may not become the stop-gap fuel of the immediate future because of long-standing labor grievances, a shortage of mining supplies, a shortage of boilers designed to use coal instead of oil and concern about environmental hazards. A new underground coal mine takes from three to five years to open, and the draglines that provide the most efficient way to strip-mine take two or three years to manufacture and erect. The United Mine Workers industry-wide contract expires later this year, and miners are expected to demand sweeping new provisions for improved working conditions, which for decades have been less safe than in most European countries, according to the report.

While conservation of energy may be laudable, the report concludes that until more energy-efficient buildings and equipment can be built over a period of years, conservation will have limited effect. Gas-guzzling large automobiles take time to replace, and a new generation of energy-saving office buildings will require years to build. Gloomily the report concludes: "It appears that shortages are here to stay for the next few years."

Over a longer period of time, however, the report says the United States has a wide range of choices among energy-saving and energy-generating plans, each providing an increasingly beneficial standard of living. To continue the present energy growth rate of 3.4 percent a year would require "very aggressive" development of all major domestic energy resources. But citizens could enjoy more goods and services even if energy growth were brought down to zero by 1985, through increased efficiencies of machines and industrial processes and careful coordination of energy resource exploitation.

For the short term, the report recommends Government action to control prices and allocate shortages, to prevent equity dislocation and undue hardship on poor people. For the long term, more research and development will be needed, together with governmental coordination of planning and data. The report issues a special plea for help to underdeveloped countries which have received "a far more savage economic blow" than the United States. □

Rheumatoid factors: Self-immunity

More than five million Americans have rheumatoid arthritis, a chronically painful and potentially crippling inflammation of the joints. But what this inflammation is due to, scientists aren't sure. However, complexes of antibodies known as immunoglobulin G have been found in the blood and joint fluids of 70 percent of rheumatoid arthritis patients. So investigators are naturally eager to learn what role they might play in rheumatoid inflammation.

The previously elusive nature of the complexes has now been identified at the University of Washington. Each immunoglobulin molecule in a rheumatoid complex (or factor) serves both as antibody and antigen, resulting in a self-associating system. In other words, the molecules in a complex have an incestuous preference for each other rather than for the usual foreign chemical enemies (antigens). The Seattle researchers, Richard M. Pope, David C. Teller and Mart Mannik, report their findings in the latest (February) PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Some investigators believe rheumatoid inflammation is caused by rheumatoid factors (SN: 9/16/72, p. 182). Pope says his group's findings do not provide additional evidence that this is so. But the findings might explain the continuing process of rheumatoid arthritis. "Once it [the complex] gets started," he says, "the fact that it reacts with itself sort of messes up the feedback system. It is possible that this could cause the production of molecules to continue even without another stimulus." □

A hypermagnetic white dwarf star

For some time now several astronomers have been examining the spectra of white dwarf stars looking for circular polarization that would be evidence of magnetic fields. Only a very few have been found. Now, from Battelle Institute's Pacific Northwest Laboratories, comes a report of a supermagnetic white dwarf, which is also the first magnetic white dwarf to show evidence of rotation.

The star is GD 229 in the constellation Cygnus. The observation was made by John B. Swedlund and Joseph Michalsky. Its magnetic field is 10 million times as strong as the earth's, and shows rapid variations that indicate, Swedlund says, rotation of the star.

One reason for looking for such objects is to give support to hypotheses about pulsars and X-ray stars. White dwarfs are one kind of collapsed end product of stellar evolution; pulsars and X-ray sources are believed to be other alternatives for the last phase of a star's life. Hypotheses about how pulsars and X-ray stars produce their signals would require them to be rotating and highly magnetic. Finding such a condition in a white dwarf helps astronomers believe in the possibility of such characteristics in the other possible results of stellar collapse. The work was done at Battelle's observatory on Rattlesnake Mountain. □