astronomy

3C 279 need not exceed the speed of light

Observations of the quasar 3C 279 with a long-baseline interferometer have caused something of a flap. They seem to show that the quasar is composed of two parts that appear to be separating at a speed faster than light (SN: 4/24/71, p. 278). Astronomers are unwilling to believe that superlight motion is actually taking place, but it has been difficult to devise likely models of 3C 279 that would explain the apparent motion as an illusion.

In the March 10 SCIENCE William A. Dent of the University of Massachusetts presents one. He bases his suggestion on observations made at the Haystack Observatory. They show that the flux density of 3C 279's signal has been generally decreasing since the beginning of 1969.

Dent presents a three-component model for the quasar. In the center is a component with a gradually decreasing flux density. On either side of it are components with stationary flux densities. A series of observations of this kind of object would exhibit the same sort of changes in the pattern of the interferometric fringes as two separating components, he says.

A binary X-ray source

The X-ray source Centaurus X-3 is a so-called X-ray pulsar with a signal that pulses every 4.8 seconds. A year's observation by the satellite Uhuru leads a group of astronomers from American Science and Engineering, Inc. in Cambridge, Mass., to believe that Cen X-3 is part of a binary system. The report, by E. Schreier, R. Levinson, H. Gursky, E. Kellogg, H. Tanabaum and R. Giacconi, is in the March 15 ASTROPHYSICAL JOURNAL LETTERS.

The evidence appears in a periodic variation of the intensity of the 4.8-second pulses and a sinusoidal variation in their length. The intensity variation is interpreted as repeated eclipses of the X-ray source by a dark companion as the two revolve around each other. The pulse-length variation is attributed to a Doppler effect that makes the pulses longer as the X-ray source recedes from the earth and shorter as it approaches on alternate sides of its orbit.

The eclipse period is 2.08712 days. The gradual occurrence of the eclipses, say the observers, indicates that the eclipsing body is surrounded by a considerable atmosphere. If the X-ray source is assumed to have a mass equal to that of the sun, the mass of the companion has to lie between 17 and 46 solar masses, they say.

Hard X-rays from the Vela pulsar

Observations made from a balloon flown on Nov. 25, 1970, from Paraná, Argentina, appear to extend the spectral range of the Vela pulsar (PSR 0833-45) into the hard X-ray range. F. R. Harnden Jr., W. N. Johnson III and R. C. Haymes of Rice University report in the March 15 ASTROPHYSICAL JOURNAL LETTERS, that a flux in the range between 0.02 million and 1 million electron-volts energy comes from the general direction of the Vela X supernova remnant, which is the location of the radio pulsar. It pulses at a rate 155 nanoseconds shorter than the 89.215879-millisecond radio pulsation period.

earth sciences

Florida reef on critical list

A healthy coral reef is a stable, self-sustaining community, in which symbiotic algae convert waste products into food. To determine effects of pollution on such a community, scientists of the underwater Florida Aquanaut Research Expedition (SN: 1/22/72, p. 59) spent three days observing a coral reef off Miami Beach that is subjected to siltation and sewage pollution.

John G. VanDerwalker of the National Oceanic and Atmospheric Administration and J. Morgan Wells of the University of North Carolina report that large parts of the reef are dead and the rest has an ecosystem radically different from that of other reefs. Symbiotic algae are largely absent and reef organisms are almost all of types that depend on sources external to the reef for their existence. Almost no young fish were seen.

The researchers believe that the heavy sedimentation, rather than sewage pollution, was the major cause of the reef's unique character. The cloudy water, from dredging, shore construction, and natural runoff, limits the sunlight essential to photosynthesis. "Maybe this Miami Beach reef can somehow survive in such a potentially lethal environment, maybe not," said Wells. "Certainly it must be put on the critical list."

Gondwanaland and the East African rift

East Africa has a complete network of faults running from southern Tanzania to the Gulf of Aden. There have been three periods of rifting, in areas progressively farther north, and it was thought for some time that the rifts were all part of a connected system that was activated periodically in different places by a mantle feature. More recent evidence suggests that the different areas of rifting are not connected (SN: 2/19/72, p. 122).

The three periods of rifting, says W. T. C. Sowerbutts of the University of Glasgow, are related not to each other but to different phases in the rifting of Gondwanaland. The first period, roughly 180 million years ago, was related to the breakup of Antarctica and Africa; the second, in the Cretaceous (135 million to 65 million years ago), with the breakup of Madagascar and Africa; and the third, which began in the mid-Cenozoic (roughly 30 million years ago) and continues to the present, is connected to the rifting of Africa and Arabia.

Aftershock mechanism

A series of aftershocks always follow large shallow earthquakes. The frequency of occurrence of the aftershocks, which declines from thousands on the first day to roughly 10 per day after 100 days, cannot be explained in terms of tectonic loading.

Amos Nur of Stanford University and John R. Booker of the University of Washington propose a mechanism for occurrence of aftershocks. An earthquake involves compression and dilation of rock as well as shear, and if the rock contains groundwater in its pores, changes will occur in pore pressure. It has been demonstrated at the Rangely oil field in Colorado that changes in pore pressure can generate quakes (SN: 4/17/71, p. 263).

In the Feb. 25 SCIENCE, Nur and Booker present a model explaining aftershocks in terms of pore pressure changes induced by the main shock. The redistribution of pore pressure slowly decreases the strength of rock and may result in delayed fracture, they suggest.