of civil engineering at Ohio University. If one chain broke, unequal stresses could have pulled over the towers.

The chances of finding that this did happen are not good. Even if investigators discover that pins are missing from their eyeholes, the probability is greater that they fell out as a result of the collapse than as its cause.

Another possible cause, says Dr. Shermer, is that stress due to the bridge loading may have found a flaw or caused a crack in one of the bars and finally brought about a rupture.

He discounts overloading of the structure as a possible cause, however, even though the bridge was crowded with Christmas traffic, including a bumper-to-bumper line of heavy trucks. As with other long bridges, the dead weight of the bridge itself is a more important factor than the weight of the traffic passing over it. Dr. Shermer figures that an overload would have dropped a portion of the deck and the offending traffic into the river but left the rest standing.

Corrosion is a third possibility, especially if it occurred at a critical point such as the base of a tower. But corrosion should have been discovered during inspections or repaintings.

The reports of the investigating commissions, when they come in some months from now, may or may not disclose the reason for the disaster. Investigators are giving no promises of when they will report, since dredging up bridge pieces from the bottom of the Ohio River is a chancy business.

New engineering and inspection standards probably will emerge, with the Federal Government taking a bigger role in making sure that states keep up their inspection procedures.

Meanwhile, people in the Ohio Valley are just a little nervous about other bridges that have similar steel bars in their construction, especially the Silver Bridge's twin, 75 miles upstream. ◇

SOURCE ONE

'Neutron star' demoted

When it was first discovered (SN: 3/16 p. 255), what is now called Pulsating Radio Source One was described, perhaps whimsically, as a possible signal from some extraterrestrial intelligence. Then more seriously, it could have been the first observed neutron star. Now, as data on the strange, regularly pulsating object is evaluated, it seems to be a still-strange but less exotic hot, white dwarf.

At least that is the theory—developed by Dr. Kip Thorne and graduate student James Ipser of the California Institute of Technology—gaining currency among astrophysicists.

Dr. A. G. W. Cameron of Yeshiva University, New York, says the source is "definitely not a neutron star," and endorses the Thorne and Ipser findings. Dr. Cameron is working on some details of the theory, such as how the energy of a shock wave becomes channeled into radiation in the radio frequency range.

Dr. Allan R. Sandage of Mt. Wilson and Palomar Observatories says his strong belief is that it is not a neutron star but a white dwarf, citing Dr. Thorne's calculations as additional substantiation.

What Ipser and Dr. Thorne have done is to show—"fairly conclusively," they believe—that the source cannot be a pulsating neutron star for one simple reason: to vary its radiation at such a rapid rate—every 1.33 seconds—would require a very low density and low mass, and to form a neutron star of such characteristics requires an inexplicable input of energy.

They have also pulled together some theories concerning white dwarfs. In 1950, Profs. Paul Ledoux and E. Sauvinier-Goffin investigated the energy source of white dwarf stars. Their conclusion was that a hydrogen-fueled white dwarf would be explosive with an uncontrolled thermonuclear reaction instead of the controlled fusion with which most stars burn.

Dr. Thorne believes that unburned hydrogen in the outer envelope could set the star pulsating when it sinks toward the core and burns explosively as the earlier model dictates. Dr. Thorne and another graduate student, David Meltzer, when they were at Princeton University several years ago, calculated the kinds of pulsations that might occur if the hydrogen surrounding a white dwarf burned explosively.

They found that any pulsation driven by an explosion in the envelope would be coupled to the first harmonic, not the fundamental mode. This means that when the surface is expanding, the center will be compressing. The periods they calculated for this pulsation are of the right magnitude for the source observed by the British radio astronomers—one-half a second to 20 seconds.

Dr. Thorne believes he has arrived at "a very attractive, self-consistent picture" for a rapidly varying radio source, but stresses that this is far from proof. He urges more calculations and more observations, pointing out that a rotating neutron star might turn out to be a correct identification. Details of his theory will appear in the April Astrophysical Journal (Letters).

Though many other astrophysicists agree with this model, there are exceptions. Dr. Herbert Friedman of the Naval Research Laboratory believes Pulsating Radio Source One is two objects, a white dwarf and a more normal star revolving around each other.

Dr. Friedman readily admits he does not know how such a combination would form, but then, he notes, no one really has a satisfactory explanation of how binary stars ordinarily form.

To determine whether or not Pulsating Radio Source One has a variable output in light waves as well as radio, Dr. Sandage with two co-workers will train the 200-inch Hale telescope on it for two nights in mid-April. He estimates the giant instrument will catch about 500 photons a second from the 18th magnitude source, while the noise level of the sky background is about 4,000 counts per second. The photon-by-photon count should show any pulsation in visible light.

Dr. William Liller, Harvard College Observatory, has searched Harvard's collection of photographs for information on the past history of the object. He examined at least one and on the average four plates taken of the area each year from 1897 to 1952. His survey shows the source was never brighter than magnitude 17.

Pulsating Radio Source One varied less than half a magnitude in brightness between 1950 and 1967, Dr. Sidney van den Bergh of the David Dunlap Observatory in Ontario has found by comparing two plates taken with the 48-inch Schmidt telescope on Palomar.

Both Drs. Liller and van den Bergh have estimated the annual proper motion of the object, a guide to its distance. They find it is somewhat more than 100 light years away, if the British identification of the visible object is correct (SN: 3/23, p. 281).

COSMIC RAYS

The search for transuranics

Primary cosmic rays arrive at the top of earth's atmosphere after long journeys through interstellar space. Where they come from, how long they have been on the way, how they got accelerated and how much interstellar hydrogen they may have encountered are all significant clues to conditions in the galaxy. The information must be read out of the picture the primaries present on arrival.

Protons make up the overwhelming majority—some 85 percent—of the primaries. The nuclei of helium isotopes 3 and 4 come to about 13 percent. All

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