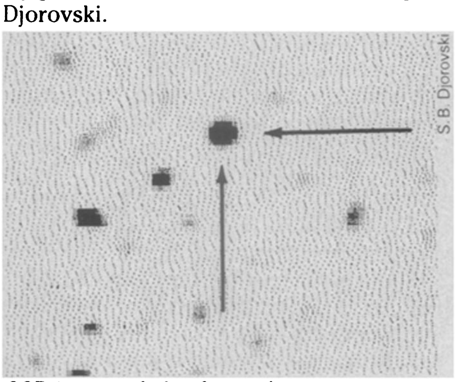
Fastest pulsar yet: 642 revs per second

A pulsar is supposed to be a rotating neutron star that emits a beam of radio waves from a spot on its surface. The signal comes to us pulsed because of the star's rotation. One term that has been used for this is "lighthouse effect." But no lighthouse on earth pulses 642 times a second. That is the pulse rate of a newly discovered pulsar, the fastest ever found, and is 20 times the rate of the previous record holder, the Crab nebula pulsar.

The new pulsar, cataloged as 1937+215, was found in the radio source known as 4C21.53 by Donald C. Backer, Shrinivas Kulkarni and Carl E. Heiles of the University of California at Berkeley, Michael Davis of the Arecibo Ionospheric Observatory in Puerto Rico and Miller Goss of the University of Groningen in the Netherlands. Shortly after its discovery in radio waves, the pulsar was identified with a 22nd magnitude optical object by a Berkeley graduate student, Stanislas B. "George" Djorovski.



CCD image of ultrafast pulsar.

Backer first suspected the presence of a pulsar in 4C21.53 in 1979, but searches with radio telescopes at Owens Valley, Calif., and at Arecibo failed to find anything. Goss then made high-resolution radio maps of the source with the Westerbork Radio Synthesis Telescope in the Netherlands and found a compact source next to a more extended source. In late October of this year Kulkarni, a graduate student, using the Arecibo 1000-ft. radio telescope and Goss's maps got the first indication of a pulsed signal. Backer, Heiles and Davis joined Kulkarni for more extensive investigations, and by Nov. 7 they had a statistically significant record of the pulsed signal. They announced the discovery in an International Astronomical Union Circular dated Nov. 12.

A pulsar spinning as fast as this — the period is 0.001557708 seconds or about 1.6 milliseconds—presents an example of extremely compact matter extremely stressed by centrifugal forces. Perhaps more important is the object's rate of energy loss. As measured by the rate at which its rotational period is slowing down, the energy loss is quite high. The IAU circular gave a slowdown rate of 3×10^{-14}, but that has since been revised downward. Two weeks later, Heiles told SCIENCE NEWS, they had refined it to be no more than 10^{-15}. That is still large, and the region around the pulsar does not show the excitation characteristic of matter near the source of such a flow. It is just ordinary interstellar gas.

That means the pulsar must be giving up most of its energy in a form that the surrounding matter cannot easily absorb. Gravitational waves are suspected. Gravitational waves are the analog of electromagnetic waves. Electromagnetic waves carry energy from place to place and cause electric and magnetic forces to appear in an antenna that are analogous to the electric and magnetic forces that generated the waves in the transmitter. Gravitational waves carry energy from place to place and cause gravitational forces to appear in a receiver. Such forces would be manifest as minute vibrations of heavy objects.

No confirmed direct observation of gravitational waves is on record. A number of antennas in the world are looking for them. It is unlikely that any of the existing antennas happens to be tuned to the frequency that this pulsar would emit, twice its radio pulse rate or 1,284 hertz, but someone may soon build one.

Meanwhile a group of astronomers working at the Palomar Mountain Observatory in California and another at the Multiple Mirror Telescope on Mt. Hopkins in Arizona are trying to find out if the optical image pulses. Only two or three radio pulsars are known to emit optical pulses, but they are the fastest ones, so there are good grounds for looking for optical pulses in this one. However, as Heiles points out, at this season the pulsar's location (in the constellation Vulpecula) goes below the horizon shortly after the sun. There's about an hour's observing time a night. In a few weeks the sun will be on top of it, and that will foreclose observation for a month or more. *—D. E. Thomsen*

Treatment for brain damage under fire

American pediatricians have formally denounced a popular but controversial approach to the treatment of children with brain damage and a variety of language disorders, claiming that the method is not only ineffective but perhaps even harmful. The criticism was immediately dismissed by the method's chief advocate, who claims to have evidence of a high success rate in treatment of more than 12,000 children during the past two decades.

In a brief statement released last week, the American Academy of Pediatrics advised its members that the method called "patterning" remains unproved and that, because of the overwhelming demands it places on families, it may lead to stress and neglect. The pediatricians argue that the improvement reported in children following patterning treatment probably results from normal growth and development rather than from improved neurological organization as claimed.

Patterning is also known as the Doman-Delacato treatment after its originators, physical therapist Glenn Doman and psychologist Carl Delacato. It is based on the theory that individual development mimics the historical evolution of the nervous system. Children who are neurologically impaired are put through a series of movement exercises, each corresponding to an evolutionary stage of brain and motor development; imposing these patterns of movement (crawling, creeping, ape-like walking) on a passive child results in normal brain organization, the theory holds. Failure of the brain to develop laterally (that is, to develop a dominant and a subordinate cortical hemisphere) is considered a cause of learning disorders, and the ultimate goal (achieved through exclusive stimulation of one side of the body) is to create the hemispheric dominance indicative of a mature brain.

The pediatricians' critique says that the theory behind patterning is "oversimplified." And existing data on treatment outcomes, it says, show that patterning is no better than "standardized care." The AAP bases this conclusion primarily on a study by Yale psychologist Edward Zigler, who found that children who received intensive patterning treatment did no better than children who spent time with foster grandparents, indicating that additional attention of any kind might stimulate children's development.

Doman, director of the Philadelphia-based Institutes for the Achievement of Human Potential where parents are trained in patterning techniques, says that the Zigler study is meaningless because the children's therapists were not as motivated as truly desperate parents are. He concedes that the treatment regimen is extremely rigorous and demanding of parents' time and money (parent training costs almost $4,000); but if parents are properly motivated, he says, the program works. He says that the AAP did not ask to examine the Institutes' case files, which he claims provide documentation for a good rate of successful treatment.

Both the AAP and Doman say that a large, well-controlled study of patterning is needed, but each claims that the other has been uncooperative in trying to organize such a study. The AAP says that the burden of proof lies with Doman (Delacato is no longer associated with the Institutes); pediatricians have been receiving an increasing number of inquiries from parents who AAP says are being made to feel guilty if they do not try patterning.

—W. Herbert