

manner, an observation Dr. Drake calls "as hard to explain as the periodicity."

The pulses also differ in time of arrival at different frequencies, indicating a plasma cloud between earth and the radiating object. Although the initial radio emission at the pulsar occurs simultaneously on all frequencies, the intervening electrons slow down the radio waves, with the drag effect being greater at low frequencies.

On this basis, calculations show that three of the pulsars are roughly 300 light years away, although the distance is known only approximately and could be one-half or twice that, Dr. Drake says. These three lie very close to the plane of the Milky Way. The fourth, known as Pulsating Radio Source Number Three, shows only one pulse and no internal structure; it is about 100 light years away and is inclined nearly 60 degrees to the plane of the Milky Way.

The three pulsars with periods ranging from 1.18 to 1.33 seconds have diameters no larger than 12,000 kilometers, about the size of earth. The singly pulsed pulsar, with a period of one-fourth of a second, would have a

diameter no larger than 4,200 kilometers; but that could be the size of a radiation source on a larger object.

Measurements of the delay in arrival time of a pulsar's radiation at different frequencies give a measure of the electron density in interstellar space, the speed of their travel being the same as that of light. This gives, for the first time, a method to determine the number of electrons in the line of sight between earth and another object without making any assumptions as to estimated factors, such as electron temperature. Any variation in the intervening electron density can be measured day-to-day, Dr. Drake noted, and this is now being done.

The value for the electron density obtained by pairing the lag in arrival times for widely differing frequencies is about a million times that typical for the earth's daytime ionosphere, thus ruling out a planetary ionosphere as the location of the retarding plasma.

Dr. Drake's co-workers include H. D. Craft Jr., D. L. Jauncey, J. M. Comella, G. A. Zeissig, E. J. Gundermann and B. S. Tanenbaum.

LSD vs. I.Q.

Trippers can't follow maps

LSD is one of the most potent drugs affecting perception. Despite that fact, little effort has been made to understand whether continuous LSD use alters vision, hearing or any other sensory function, leaving permanent changes in an individual's view of the world.

A leading authority on LSD has now found such a change in visual perception among 30 heavy drug users in Los Angeles who had trouble following directions on a road map test.

The test is given to measure spatial orientation. With map in hand, the subject must walk out a route, often complex, between cities marked as dots on the floor. Drug users would turn east when they should have turned west; north instead of south. None were on drugs during the tests, but the LSD users nevertheless did considerably worse than a non-drug group used as controls, report Drs. Sidney Cohen and Allan E. Edwards of the Veterans Administration Center in Los Angeles.

Curiously enough, drug users did as well as anyone else with a wooden map marked in braille relief. "The trouble has something to do with visual space," says Dr. Edwards. Normally such spatial impairment would be attributed to brain damage, but the drug users were not deficient in any other intellectual or perceptual function tested. Consequently, the investigators believe LSD causes a learned perceptual change. "If

you take enough trips on LSD, you learn to look at space differently," comments Dr. Edwards.

Apparently because of this visual change, the heaviest drugs users—those who had taken LSD more than 100 times—also did worse on I.Q. tests. Intelligence scores were inversely related to the number of trips, says Dr. Edwards. There was roughly a 10-point drop between the 50-trip drug users and those who had used LSD up to 500 times. The heaviest users clustered below the drug group's mean I.Q., which was fairly high in any case.

Users and non-users alike came from an above-average social-economic class and included professors and lawyers. The groups were matched as closely as possible for age, sex, race and years of education.

Since the investigators do not have original I.Q.'s on their drug users, they cannot prove LSD caused the intelligence drop. But the other alternative—that less intelligent people take more LSD—does not stand up well. Everyone in the drug group had used LSD at least 50 times and often a variety of other drugs, including marijuana, psilocybin, dimethyltryptamine, barbiturates, amphetamines, methedrine, opiates and cocaine.

None of these drugs, unlike LSD, showed any correlation with altered visual perception or intelligence.

DUGWAY

Dead sheep and sick men

Amid the horror of thousands of dead sheep, apparently poisoned by a nerve chemical blown over their range from the Army's nearby Dugway Proving Ground (SN: 4/6, p. 327), there appeared to be at least some grounds for relief. No other animals were affected, said reports, though the pastures harbored many other species. Best of all was the news that no people had been affected.

Now there are signs that both of those optimistic beliefs may have been wrong.

Some 18 days after the first sheep deaths, a columnist reported that two veterinarians who had performed autopsies on the sheep had subsequently experienced nausea, headaches, dizziness and diarrhea. Such symptoms could be those of anticholinesterase poisoning, typical of the nerve chemical.

Several researchers involved in the sheep investigation branded the report "sensationalistic," and "without any foundation." The veterinarians had driven 140 miles and then worked all day long without rest, said one investigation. "It was snowing, it was raining, it was nasty and it was muddy. When they came in that night, they apparently said they were tired. That's all."

However, one of the doctors mentioned in the column, Dr. Lynn James of Utah State Agricultural College, admitted that he had had those symptoms, but said that they could just as easily be the result of the flu as nerve gas. "I could guess either way and be wrong," he said.

All this time the Army had been denying, although increasingly weakly, that its chemicals could definitely be blamed for the disaster. Soon afterward, however, Utah's Democratic Senator Frank E. Moss announced "proof positive" that the Army testing was responsible. Comparative tests by the U.S. Department of Agriculture, he said, had revealed that a chemical found in sheep tissue and in forage from the grazing site was the same nerve agent used by the Army in its experiments. The Public Health Service turned up identical traces in snow from the area, after examining samples at its Communicable Disease Center in Atlanta, Ga.

The Army, meanwhile, continued to raise the question of why anticholinesterase symptoms were found only in sheep, when there were horses, cattle and many other creatures in the same area. The main counter-response has been that sheep were the only chronic snow-eaters in the area, and that they took in the chemical that way. Such an