Some sort of mass change is also the explanation of Dr. A. G. W. Cameron of the Belfer Graduate School of Science in New York, who calculates that the observed variation in period could result from the addition to the neutron star of a mass about one-half that of the earth's moon—about 10^{25} grams—spiraling into the pulsar. He notes, however, that there is not much debris of that size floating around in space. It could also have resulted when the rotating star compressed slightly, which is the equivalent of adding mass to the object.

Discovery of the spin increase of pulsar 0833-45 was made by Drs. Paul Reichley and George S. Downs using the 85-foot Goldstone tracking antenna of the Jet Propulsion Laboratory in California. The decrease in pulse period, indicating an increase in spin, was observed to be 134 billionths of a second between Feb. 24 and March 3. Its period was 0.0892092047 seconds on Feb. 24 and 0.0892090710 seconds on March 3, both with an error of only one part in 10 billion.

The period decrease was also observed at the Parkes Radiophysics Laboratory of the Commonwealth Scientific and Industrial Research Organization in Australia. ◇

EXCITONS

The fission of nonparticles

When light is shone on certain substances, it is absorbed and then reradiated. This property of the materials, known as fluorescence, is both the basis of a number of practical devices and the object of a good deal of pure scientific study.

One mechanism by which fluorescence takes place involves so-called excitons, localized energetic disturbances that can travel through the bulk of a substance as if they were particles. They are treated mathematically in the same way as particles would be.

New work at New York University shows that light-generated excitons can split in two, and thereby become a means of transporting and changing energy in such things as biological processes.

Usually in fluorescence the function of an exciton is to hold the energy delivered by the incoming light for a short time, say a hundred-millionth of a second, and then reradiate it. The NYU work shows that, in a few cases, such an exciton can fission into a pair of daughter excitons with much longer lifetimes than their parent.

Such long-lived excitons can carry the energy over long distances, molecularly speaking, and have more opportunities to transmit their energy in forms other than light. Thus they could play a role in the transfer and transformation of energy in biological processes. One example where such a role could be possible is the way a leaf uses light in photosynthesis.

The work grew out of an exception in excitonic fluorescence.

In most cases excitonic fluorescence is quite efficient: In the substance anthracene, for example, 95 percent of the impinging light is reradiated as fluorescent light. But there are exceptions. In tetracene, a molecule of similar structure, the efficiency is only two-tenths of a percent.

It was the extremely weak fluorescence in tetracene that led Drs. C. E. Swenberg and W. T. Stacy to propose the theory of exciton fission.

Normally the decay of a short-lived exciton into a single long-lived one is what is called a forbidden process: The laws of probability and the selection rules that govern atomic and molecular happenings give virtually no probability of occurrence. But a pair of long-lived offspring, produced by the splitting of a short-lived exciton, is not forbidden, according to theory. Such fission can happen if the energy possessed by the daughters is equal to that of the parent.

The experiments done by Drs. Nicholas Geacintov and Martin Pope and graduate student Frank Vogel show that exciton fission is exactly what does happen in tetracene, and the energy transformation takes routes other than reradiation.

By placing the tetracene in a magnetic field and then varying the field, theory told them, they could vary the probability of fission taking place, and this variation should show up as changes in the fluorescence efficiency of the tetracene. When they did it, the experimenters found the fact came out as predicted: The fluorescence efficiency of tetracene single crystals was enhanced as much as 38 percent in a magnetic field above 2,000 gauss.

The daughter excitons live up to 100,000 times longer than their parent. In molecular terms this means that while the parent might be able to go through perhaps 50 molecules, the daughters can travel on the average through anything from 200 to 2,000 molecules.

The daughter excitons can thus not only carry energy through more of the substance; they have also a higher probability of encountering nonradiative means of giving up their energy. A collision with some impurity in the crystal structure is one example suggested by Dr. Geacintov.

The NYU experimenters are now looking for even longer-lived excitons in substances more directly involved in biological processes than tetracene.

ARTIFICIAL SWEETENERS

New labeling requested

Safe limits of artificial sweeteners in cans or bottles will be stated on the labels, taking effect by May 5, if manufacturers do not request further hearings, the Food and Drug Administration has announced.

A National Academy of Sciences-National Research Council committee estimates that soft drinks account for 70 percent of non-nutritive sweeteners, largely cyclamates, with saccharin combined in smaller quantities.

The new regulation would require a statement on the label that adults weighing 154 pounds should not consume more than 3,500 milligrams a day, and that the 54-pound child should not consume more than 1,200 milligrams. The average soft drink in a 12-ounce bottle may contain from 250 to 1,000 milligrams of cyclamate.

Drinking or eating 5,000 milligrams or more of cyclamates a day can have a laxative effect (SN: 10/26, p. 428) and may mean consuming too much of the basic chemical cyclohexylamine from which the cyclamates are manufactured. The FDA regulation would establish that cyclamates could not contain more than 25 parts per million cyclohexylamine.

Animal studies have shown that cyclohexylamine increases blood pressure and speeds heart rates, as well as causing tissue changes in the testes, liver, kidney, adrenals and pancreas. Cyclamates also appear to affect the action of drugs.

DRUG COMBINATIONS

Marketing faces ban

The Food and Drug Administration is starting action against 78 drug products found ineffective because they combine antibiotics that should be used alone.

The majority of the products are antibiotic-sulfa combinations in tablet, capsule or liquid form.

Last December, 12 other products were ruled ineffective, but a decision is still pending on whether manufacturers of these drugs should have additional time to submit evidence of efficacy. The usual time is 30 days.

The Federal Register of April 2 listed 21 firms that are producing the combinations, some of which have been sold for many years. The FDA decision was based on recommendations of the National Academy of Sciences-National Research Council, which is evaluating the effectiveness of a total of 3,600 drugs marketed from 1938 to 1962 (SN: 1/11, p. 33).