

LSD is responsible for any kind of mutant action it is not by direct interaction with the DNA molecule."

The University of Miami researchers were unable to find any optical activity changes when DNA and LSD were mixed and they could not repeat or confirm Dr. Wagner's spectra. Dr. Brady says that their experiments, the evidence of Drs. Smit and Borst and mounting physical and chemical evidence "are beginning to refute evidence that we might have been inclined to believe a year ago." □

CIRCULAR POLARIZATION

Astronomers' new tool

Visible light is the age-old observing tool of astronomers. Nevertheless new kinds of information can be gained by studying characteristics of visible light not systematically investigated before. One such characteristic making news lately is circular polarization.

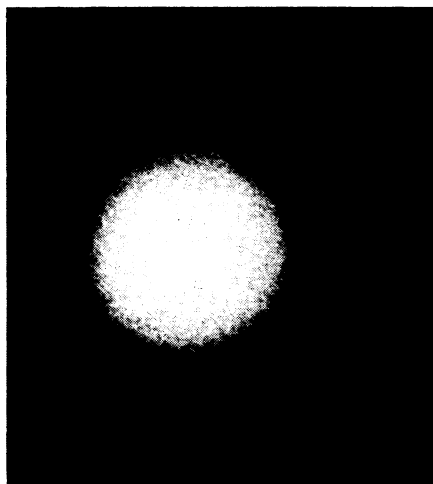
The search for circularly polarized light from astronomical bodies began as a means of looking for magnetic fields in certain kinds of white dwarf stars. Dr. James C. Kemp of the University of Oregon had put forward a theory that magnetic fields in white dwarfs would cause a net circular polarization. A few such stars have so far been found.

Circular polarization has also been found in the light reflected by the planets. The latest report, by Dr. Kemp and Drs. Ramon D. Wolstencroft of the University of Hawaii and John B. Swedlund of the University of Oregon in the July 16 *NATURE*, brings the total of circularly polarized planets to four, Mercury, Venus, Mars and Jupiter, plus the moon.

A quasar (3C 273) and a Seyfert galaxy (NGC 4151) also emit circularly polarized light, according to the report of a group at the Crimean Astrophysical Observatory in the Soviet Union led by Dr. Andrei Borisovich Severynj. The report appears in *International Astronomical Union Circular* 2343, dated July 23.

Circular polarization imposes a particular order on the vibrations of a light wave. All light waves consist of vibrating electric and magnetic fields. The electric and magnetic vibrations are always perpendicular to each other. As long as they maintain that relationship, the vibrations can be in any direction in the plane perpendicular to the line along which the light wave is propagating, and in an ordinary wave the direction can vary at random from time to time. In a circularly polarized wave, the variation is regular and smooth and describes a circle like the hand of a clock, either clockwise or counterclockwise.

A number of things beside magnetism at the source can cause circular polarization. In particular, the circular polarization in light from the planets appears to be due to scattering that selects particular polarized components of the impinging sunlight. Dr. Kemp and several collaborators originally drew this conclusion in an earlier paper dealing with Jupiter. A note on that discovery (SN: 6/5/71, p. 386) reported their conclusion erroneously. The Crimean astronomers have not yet suggested



NASA

Uranus: Target of polarization study.

what may cause the polarization in the quasar and the galaxy.

The scattering that causes the circular polarization in the planets may occur at a gaseous surface, that is, in the planet's atmosphere or at the solid surface. The characteristics of the light vary according to where the reflection is taking place.

Two planets, Jupiter and Venus, show pronounced polar effects. The polarization at the north and south poles of the planets is in different senses, indicating, the observers conclude, that the polarization has to do with their atmospheres. For Mercury and the moon the indication is that the polarization is caused by reflection from a dusty solid surface. Mars shows both effects, atmospheric at blue wavelengths and dust at longer ones. Uranus and Neptune were also observed, but the data from them are not yet significant. There is hope, however, that they will become significant in the future.

All in all, the present observations of circular polarization promise to provide new data on the details of planetary surfaces and atmospheres. If other sources of polarization besides scattering turn out to exist, more varied information could be gained. For example, Martian plant material with optical properties like those of green leaves could cause circular polarization at 7,000 angstroms wavelength. □

POLLUTION AND ECONOMICS

Measuring the real costs

A cliché heard with increasing frequency is that if the American people want a clean environment, they will have to pay for it—and their "high standard of living" will necessarily suffer. The statement, a favorite with Nixon Administration officials, is superficially plausible; it seems obvious that corporations that pollute must install expensive equipment to clean up their emissions and effluents. The money must come to them from higher prices to consumers, or from higher taxes to taxpayers through tax writeoffs on abatement equipment, through outright Federal grants for abatement research and development, and so forth.

Such a view oversimplifies reality, according to such economists as Harvard's John Kenneth Galbraith. These economists agree with environmentalists that many other questions must be asked. The key one, perhaps, is what is the cost of continuing to pollute the air and water? But there are others. For instance, there is the related question of how to measure the quality of American life and the extent to which more consumer goods and increasing energy consumption either add to or detract from this quality. Another question is whether the consumer or taxpayer must really always pay for abatement. Could some companies, for instance, reduce costs in other areas—such as advertising—so as to pay for pollution abatement?

None of these questions are easily answered, partly because they deal as often with unquantifiable intangibles as with tangible items to which a dollar value can be assigned. Galbraith has recently spoken of "external diseconomies," uncalculated human and ecological costs of modern technology. But it is difficult to calculate in dollars the cost of a massive fish kill (especially if the fish are not commercially valuable) and it is even more difficult to gauge and assign a dollar deficit to possible mental health effects of urban air pollution (SN: 7/17/71, p. 43).

Some of the diseconomies are measurable, of course. Some 100 dock workers were made seriously ill by air pollution along the Houston, Texas, Ship Channel in four air-pollution incidents since April 22. The medical costs (if not the pain and inconvenience) of the 100 workers should be clearly quantifiable. A Texas air-quality agency is asking for a shutdown of the chemical plant accused of causing the incidents.

But there are startlingly few detailed studies of the "external diseconomies." A 1913 Mellon Institute study of smoke pollution in Pittsburgh showed per capita costs averaged \$20 a year;

most subsequent estimates have been based on extrapolations from this study.

However, the U.S. Public Health Service in the 1960's studied certain costs related to air pollution in Steubenville, Ohio, and Uniontown, Pa., as reflected in six general categories related to home, office, store and clothing maintenance. In the much more heavily polluted Steubenville, annual costs (in 1960) ran \$84 higher per capita than in the far less industrialized Uniontown. A later study of Washington, D.C., suburbs showed similar proportionate differences in maintenance costs related to air pollution.

The available studies are extremely limited; the Steubenville, Uniontown and Washington ones relate only to maintenance costs and do not include, for instance, medical costs due to air pollution. But the absence of quantifiable data does not invalidate the concept of "external diseconomies." A Long Island resident who loses several hours of sleep a night because of jet noise from aircraft approaching nearby Kennedy airport pays a very real price.

Galbraith says part of the answer may lie in more realistic estimates of the value of growth. If a fourth airport is not built for New York City, he says, "the growth of air travel into and out of New York will at some period no longer increase." Thus, he says, some air traffic will be redistributed to Boston, Philadelphia and Washington, and some industries will locate elsewhere than in New York.

"Since almost everybody agrees that New York is already too big, this is a result which one should face with equanimity," he says.

In an interview this week with *SCIENCE NEWS*, Galbraith made two other points: Over-all economic growth can be slowed down in the interests of preserving the environment with no traumas such as massive unemployment necessarily resulting. Actually, he said, the choice is an optimistic one "between a rapid rate of growth and a more pleasant life. . . . A single-minded concentration on growth is not the answer."

Second, Galbraith said it is practical for the nation to massively shift priorities so as to give more emphasis to preserving the environment; this might create unemployment in some sectors, he said, but it would lead to an increase in employment in other sectors.

"Senior professors at Cambridge where I taught last year," Galbraith said, "had as high, or higher, standard of living at one-half the salary of my Harvard colleagues. There were so many external amenities that made life easier.

"There was good bus service, there was a good train to London that left

every hour and saved one the necessity of driving in the horrible London traffic. There was a good underground [subway] in London when one arrived. And there were excellent public schools for the children of the professors. The wives didn't have to wrestle the children off to school in the morning and the same when it was time for the children to come home; transportation was provided. There was plenty of open space and well-supervised playgrounds, and no problem of

looking after the children; there was a good police force."

Plenty of new employment could be created in the United States if the nation began to provide some of the Cambridge amenities, the Harvard economist declared. As to claims by such groups as the National Petroleum Council that the nation is locked into ever-accelerating growth in, for instance, energy use, he commented, "One should not confuse inspired self-interest with truth." □

AEC CHAIRMANSHIP

An economist for a chemist

After 10 years as Chairman of the U.S. Atomic Energy Commission, Dr. Glenn T. Seaborg has resigned. The resignation was not entirely unexpected since in recent years Dr. Seaborg has accepted reappointment with a certain reluctance. He was first appointed in 1961 by President Kennedy.

To replace Dr. Seaborg President Nixon has chosen Dr. James R. Schlesinger, who is now assistant director of the Office of Management and Budget. Dr. Schlesinger, who earned his degree in economics at Harvard, worked for the Rand Corp. before joining the Nixon Administration in 1969. (He is no kin to Arthur M. Schlesinger Jr., the Harvard historian, who was prominent in the Kennedy Administration.) Dr. Schlesinger's appointment appears consistent with the managerial businessman's approach of the present Government. It will certainly give food for thought to those Washington watchers who believe that the OMB is the true imperial power in the Nixon Administration.

Dr. Seaborg is a chemist with a particular interest in nuclear chemistry. He has been especially active in the discovery of new transuranic elements, a program on which he worked for a long time at the Lawrence Radiation

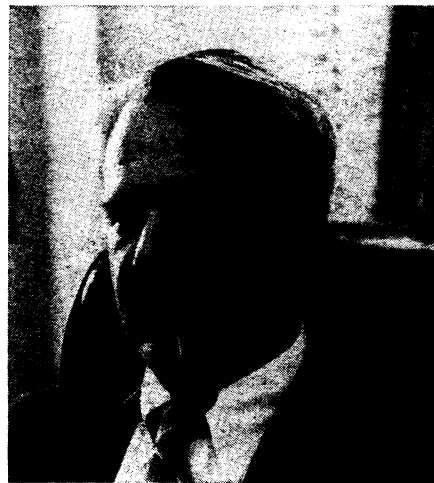
Laboratory at the University of California. For this work, especially the discovery of plutonium, he won the 1951 Nobel Prize in Chemistry.

During World War II Dr. Seaborg headed the group at the University of Chicago's metallurgical laboratory that worked on methods of plutonium production. Between 1958 and 1961 he was chancellor of the Berkeley campus of the University of California. He is currently on leave as a professor of chemistry at Berkeley and has said he will return to his professorship.

The exact date on which Dr. Seaborg will leave the AEC has not been announced, but it will not be until after he has visited the Soviet Union as head of an American delegation to visit peaceful nuclear energy facilities in the U.S.S.R. The dates of the visit are Aug. 4 to 20; it will return a visit to the United States by a Soviet delegation last April.

At the same time that he announced the nomination of Dr. Schlesinger, President Nixon also announced the nomination of William Offutt Doub of Baltimore to be a member of the AEC, succeeding the late Theos J. Thompson. Doub is a lawyer.

Both new appointments are subject to confirmation by the Senate. □



White House



AEC

AEC chairmanship: Economist Schlesinger (left) replaces chemist Seaborg.