# Star works receive physics Nobel

Subrahmanyan Chandrasekhar of the University of Chicago, one of this year's winners of the Nobel Prize in Physics, was quoted as saying that his work tends to become appreciated some time after it is done. In recent years the committee that awards the prize has veered between honoring well-seasoned work and work that was hot off the anvil, so to speak—such as the awards to Sheldon Glashow, Steven Weinberg and Abdus Salam for unified field theory or to Samuel C.C. Ting and Burton Richter for discovery of the psi particle.

The work honored in this year's prize is well seasoned indeed. Chandrasekhar's work on stellar collapse goes back more than 50 years. The work of William A. Fowler of the California Institute of Technology, the other physics winner, on nuclear processes in stars goes back 26 years and more. In the intervening time both contributions have been woven into the fabric of stellar astrophysics like the basic grammatical processes of a language. The famous 1957 paper (by Burbidge, Burbidge, Fowler and Hoyle) in which the main principles of Fowler's thought on stellar manufacture of chemical elements are expressed, is often referred to simply by the initials, BBFH. Every stellar astrophysicist knows which paper is meant.

Sometimes, when the committee splits the prize, the pairings or conjunctions seem a bit farfetched. In this case, although the two recipients have not worked together, the relation between their two achievements is close and complementary. Chandrasekhar's work on the collapse of old stars led to the derivation of the Chandrasekhar limit, 1.4 times the mass of the sun. Below that limit stars collapse quietly to white dwarfs. Above it, they undergo supernova explosions and leave behind neutron stars or black holes. As sometimes happens in astronomy, after the prediction of white dwarfs, observers went out and looked, and by now they have catalogued a large number of them.

Univ. of Chicago

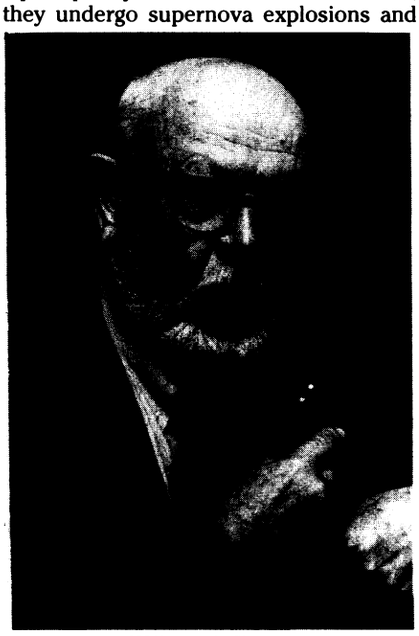
*Subrahmanyan Chandrasekhar*

It is in the supernova that the two men's work comes particularly together. Without stars the universe would not have chemical elements heavier than lithium. What Fowler showed was how stars, during their lifetimes and in their supernova death pangs, can produce all the chemical elements we know in the abundances we see.

A native of Lahore, India (now in Pakistan), Chandrasekhar was educated at Cambridge University in England and has been at Chicago since 1946. Fowler was born in Pittsburgh and educated at Ohio State University and Caltech.

*—D.E. Thomsen*

Wide World Photos



*William A. Fowler*

# Inorganic chemist wins Nobel Prize

He might have written novels, but instead he studied electrons. "I had intended to be an English major," said the winner of the 1983 Nobel Prize in Chemistry, Henry Taube. But the Canadian-born Stanford University chemistry professor added, "I was so innocent and inexperienced I didn't know how to register. I had a friend who was in chemistry, and he showed me."

The prize committee recognized Taube, 67, last week for his pioneering work in inorganic chemistry and cited his work on the mechanism of electron transfer reactions, especially in metal complexes. "He posed the question, 'How does the electron get from one place to another?' and answered it," said Joseph Earley, a former post-doctoral student of Taube's and presently a professor of chemistry at Georgetown University in Washington, D.C.

Taube contributed to the understanding of both substitution and oxidation-reduction (redox) reactions. He noted that the rates at which substitution reactions occur vary enormously, by factors of a billion or more in very closely related metals, and depend upon electronic configuration. This knowledge allowed him to design experiments that showed, rather than implied, that in some redox reactions electrons do not jump from one complex to another but are transferred by an atom bridge.

Stanford Univ.

*Henry Taube*

"He bridged the gap between descriptive inorganic chemistry, which is all those reactions one has to memorize in high school and college, with the basic principles of thermodynamics and kinetics," says another former Taube student.

Taube says that the prize was in recognition of his field and not just himself. His colleagues agree that the prize was awarded for his lifelong contributions and not just one experiment. But according to James Collman, also a professor of chemistry at Stanford, "Taube built an edifice, which *is* the field."

*—J.C. Amatniek*

# How to enlighten computer logic

Lasers, light-emitting diodes and glass fibers that efficiently transmit their light, have roused the expectation that optical circuitry will someday compete with electronic circuitry in many applications. Light beams moving through fibers will thus do the things that currents of electrons moving through wires or semiconductors now do. All-optical communications circuits are on the verge of existence. All-optical computers will have to wait awhile, but at last week's meeting of the Optical Society of America in New Orleans, researchers from Bell Laboratories and the University of Arizona reported experiments with optical switching devices that could find application in both communications and logic circuits.

These devices use optically bistable devices, that is, they employ materials that change their refractive index under a proper stimulus. Such devices can be used

as optical switches. Thirumalai N.C. Venkatesan of Bell Laboratories in Murray Hill, N.J., who performed the work with colleagues at Bell Labs and the University of Arizona in Tucson, reported experiments with a device in which a thin layer (3 micrometers thick) of gallium aluminum arsenide was sandwiched between mirrors. A kilometer of optical fiber was connected to either side of the device. The idea, Venkatesan says, was to see whether light that had come through that much ordinary single mode fiber would trigger the action of the switch. It does.

From one side came a clock pulse, a regular beat from an argon laser; from the other came picosecond pulses from a signalling device called a word generator. When the two pulses coincide, the switch turns itself on and switches the information to a third line. When the two pulses do not coincide, the switch is off. Venkatesan sees applications in switching information from one carrier wavelength to another, in multiplexing (interweaving information from several messages in the same carrier channel) and in regeneration of signals that have been degraded by absorption and dispersion during transmission. Optical communications circuits now generally use electronic regenerators.

J.L. Jewell, of the University of Arizona, described a device in which a dye is sandwiched between mirrors to form what is called a Fabry-Perot etalon. The dye changes refractive index when heated, so that shining laser light on the device effectively turns it on. In the dark it relaxes back to the off position.

The device mixes two input beams, which may contain information and a "probe" beam to make an output beam. The output varies according to the relative characteristics of the inputs, and by manipulating these the device can be made to perform the functions of all the kinds of logic gates used in computer circuitry (OR, NOR, AND, NAND and XOR).

If the input beams are strong enough, the etalons will operate in sequence, generally a requirement for any useful logic circuitry. Since they have mirrors on both sides, they will operate in two directions at once. Logic circuits generally have large numbers of gates, and a particular piece of information must be addressed to the proper one for a given step in the operation. Jewell, showing a sketch of a planar array of these devices, explained that the input beams could be directed to the proper gate by mirrors and lenses.

*—D.E. Thomsen*

# Garden home remedies give mixed results

Marigolds and nasturtium may brighten up a cabbage patch, but will they boost the gardener's harvest? Popular gardening books have recommended, as a non-toxic means of pest control, surrounding the crop plants with herbs or other plants whose aromatic leaves or flowers are thought to repel insects. Now scientists report that several species of companion plants do reduce the number of pests, but they also substantially reduce the vegetable yield.

The companion-plant strategy is one of several home remedies used to control garden pests that may have merit, but had not been tested under controlled conditions, say Carlton S. Koehler, Leslie W. Barclay and Thomas M. Kretchun. They evaluated several remedies at the University of California Deciduous Fruit Field Station in San Jose. In the test of companion plants, they grew cabbage and beans alone and in close association with anise, basil, catnip, marigolds, nasturtium, sage, summer savory and thyme. One vegetable plant was centered in a 14-inch square made up of four companion plants. The scientists periodically counted imported cabbageworm eggs and larvae on the cabbage plants and greenhouse whitefly nymphs on the beans.

The companion strategy was a failure in the beans. Those plants had the same or more whitefly nymphs than did the other plants. In different tests on the cabbages, anise, nasturtium, marigold and catnip reduced egg or larvae counts. Only marigold, however, significantly decreased the total worm damage to the cabbages.

The discouraging finding was that all companion plants tested reduced the weights of the cabbage heads. When the scientists tried planting only two companion plants per cabbage, they found no decrease in insect damage but still a drop in yield. Nasturtium had the smallest effect on yield; the average head of cabbage weighed 128 grams instead of the control weight, 301. Catnip had the largest effect, decreasing head weight to just 24 grams.

"Yield reduction probably resulted from competition for resources, such as sunlight and possibly soil moisture and nutrients," the investigators say.

Other home remedies for the garden appear more promising. Koehler and colleagues find that barriers of several types are effective against brown garden snails. These include screens and mounds of ashes, diatomaceous earth (a light, siliceous material) and ground cedar sawmill by-products. But sand barriers are ineffective, they report.

The scientists also find that soaps and detergents applied frequently to garden plants have some value for control of such pests as aphids and mites. But the soaps and detergents did not work as well as conventional pesticides. Again, as with companion plants, the yield suffered. In one test of cabbage plants sprayed with soap, the harvested cabbage weighed 23 percent less than untreated cabbages.

*—J.A. Miller*

# The pill revisited: New cancer link?

The oral contraceptive pill, in addition to its role in preventing pregnancy, has been cast as both a cancer causer and a cancer preventer. Two studies in the Oct. 22 LANCET reflect on the pill's more ominous role — one links pill use to cervical cancer, the other to breast cancer.

University of Southern California (USC) researchers reported an association between use by women under 25 of pills with high levels of progestogen and subsequent breast cancer. Pills with low progestogen content increased breast cancer risk "little or none at all," they say.

The Los Angeles researchers matched 314 white, U.S.-born women with breast cancer diagnosed before the age of 37, to 314 women of approximately the same age who lived in the same neighborhood. Overall, women who began using the pill before the age of 25 and used it for more than six years were at nearly five times the risk of breast cancer.

The findings counter a report from the Centers for Disease Control in Atlanta and the National Institutes of Health in Bethesda, Md., in the March 25 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, citing no increased risk of breast cancer among pill users. The Californians suggest that the older age of the women in the government study and the likelihood that the women had not used the pill at a young age may explain the discrepancy.

The government study also found that oral contraceptive use was responsible for preventing approximately 2,000 cases of endometrial cancer and 1,700 cases of ovarian cancer in the United States each year.

The second LANCET report blamed the pill for some cases of cervical cancer. Researchers from the Radcliffe Infirmary in Oxford, England, looked at the incidence of cervical cancer in 6,838 women using the pill and 3,154 women using IUDs. "All 13 cases of invasive cancer occurred in women in the oral contraceptive group; nine had more than six years' use of the pill," they report. They also found earlier forms of the cancer more often in the pill users.

Neither study recommends giving up the pill, but both suggest an increased awareness of the pill's darker side. Cervical cancer is treatable when caught early; the British group thus recommends that women who have using oral contraceptives for more than four years see a doctor regularly. For younger users, the answer may be a switch in pill type. "Assuming these new findings are substantiated," says Malcolm Pike, director of the USC study, "then the answer to this problem is simply for women under the age of 25 not to take pills with a high progestogen content."

*—J.Silberner*