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William Jackson: Science Is His Tool, Advocacy His Passion

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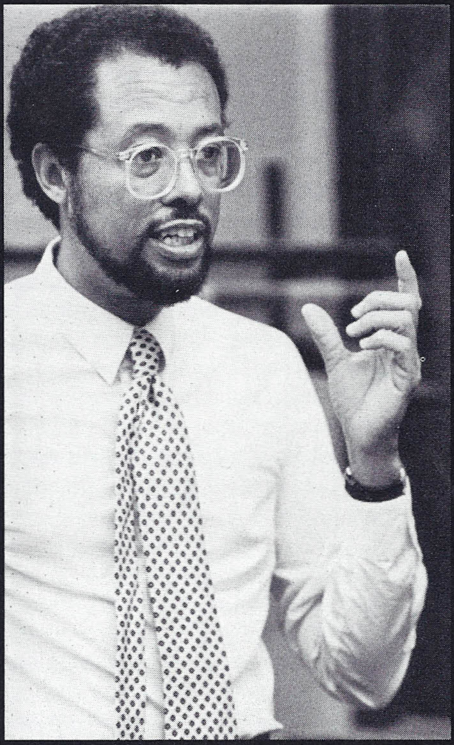


WILLIAM JACKSON

Science is His Tool, Advocacy His Passion

By Harriet Jackson Scarupa

William M. Jackson, prominent laser chemist, dedicated teacher, vigorous crusader for increased Black participation in the sciences, is annoyed. Not only annoyed, but appalled.

I'm sitting in his office and I've had the audacity to tell him 1) that I don't know anything about science, and 2) that science is "hard."

"Everybody should know elementary chemistry and physics and mathematics— I don't care what their desires are," he exclaims. "I think it's appalling the way the educational system has allowed people to become scientifically illiterate. People should never be afraid to learn about the world around them. And I do *not* think science is hard. Science isn't hard!!! How can this be hard?..."

With that, he jumps up from a chair in his basement office on the campus of Howard University and heads for a screen, magic marker in hand. Rapidly, he jots down a series of letters, number, symbols. "See this is the molecule cyanogen," he explains, penning in $N\equiv C\text{-}C\equiv N$. "What I was trying to tell you about my work [in laser chemistry] is that all I do with light is use it to break apart this molecule at the C-C bond. When I shine light on it (he shows a curving arrow), *this* (he pens in still another symbol) goes in this direction and starts doing things; it starts vibrating...."

His fingers whizz across the screen. The explanations crescendo. Then he turns, accusation shaping his voice, and he asks: "Now is that hard?"

"Well, *maybe* that makes sense," I concede, referring to the explanation he's just given. "But that doesn't mean science, in general, isn't hard. What about all those arcane words scientists seem so fond of using? Why can't you scientists explain your work in term all of us ordinary folks can understand?"

"It is true scientists set up words for very precise definitions that are different from the words you use every day," Jackson counters. "But that doesn't mean that the concepts are foreign to you because you probably understand most of the concepts to begin with.

"Take the word laser. Laser is an acronym for Light Amplification by Stimulated Emission. To say you don't understand that is not quite true. You know what light is. You have a concept of what an amplifier is—something that increases something in some way. You know what stimulation is. And you know what it means to emit. So you already have a certain amount of information about what a laser is....Why do you keep saying science is hard? Science isn't hard!!!"

And so goes another episode in William M. Jackson's perennial battle to wipe out what he sees as the appalling and ludicrous (two favorite words) scientific illiteracy in this country.

But that is just one of Jackson's strongly-waged campaigns.

There's also his campaign to increase the number of the nation's Black scientists. And then there's that other campaign, one that consumes him as it does scientists of all hues: the campaign to push aside a little more of man's ignorance about this universe of ours and how it works.

Before looking closer at these campaigns, let's take a closer look at the man behind them. What's he like, this William M. Jackson? A man of forceful opinions, that we already know. A man who loves science, that we know too.

Yet, he doesn't look like a scientist, that's if your image of the scientist remains cast in the disheveled-hair, baggy-sweatshirt-and-pants Einstein mold. With his color coordinated blazers, slacks and tapered shirts, copper and silver elephant hair bracelet and neatly trimmed goatee, Jackson looks like he'd be more at home in a trendy New York ad agency than poring over reams of scientific data. Not that he doesn't exhibit a few eccentric touches, most notably those circular glasses he never seems to know what to do with, and that distinctive voice that seems second cousin to a foghorn.

Then there's his office, one that would surely give any trendy interior decorator instant migraine. It's a jumble of books (e.g. "Atomic Physics," "Foundations of Chemical Kinetics," "Study of Comets," "Lase[r] Spectroscopy"); journals; magazines; roll[s] of computer printouts; sheets of yello[w] paper covered with chemical formulae; a[r]ticles and proposals in various stages o[f] completion; coffee cups in various stage[s] of cleanliness; a pair of jogging shoe[s] dangling from a closet door; pictures of hi[s] son, a chemical engineering student a[t] Howard and his daughter, a premed stu[-]dent at Brown University; piles and piles o[f] mail...

The office's visual pollution seems pe[r]fectly matched by its noise pollution. Com[-]pressors, hammers and saws boom[,] pound and shriek in the background as th[e] renovation of the old Freedman's Hospita[l] building continues ad infinitum, while in th[e] foreground Jackson's telephone ring[s] again and again. Calls from a supplie[r] about equipment Jackson needs for th[e] lab. Calls from a postdoctoral fellow on hi[s] research team about some critical data[.] Calls from a Canadian scientist about th[e] possibilities of engaging in a joint researc[h] project. Calls from a university in Californi[a] with an invitation to deliver a lecture.

The nature of the calls gives some clue t[o] the importance of the man who reigns ove[r] this noisy, cluttered domain.

A professor of chemistry at Howard[,] Jackson has earned a national and interna[-]tional reputation for his work in lase[r] chemistry, that space age branch of sc[i]ence which utilizes lasers (unique mono[-]chromatic, highly directional and therefore extraordinarily intense, light beams) to ge[t] basic information about chemical systems[,] information scientists were unable t[o] gather in the past through more traditiona[l] techniques.

Through the years, he has made nume[r]ous scientific breakthroughs in this seem[-]ingly esoteric field, breakthroughs whic[h] provide fundamental information abou[t] that fundamental particle of all substances[,] the molecule. Some samples:

He pioneered in the use of tunable dy[e] lasers (special lasers which can be tune[d] to a given wavelength) to study th[e] dynamics of photodissociation, the breaking apart of molecules by light.

He was the first to show that UV lasers (lasers in the ultraviolet region of the spectrum, the region that is invisible to the naked eye) can be used to put two elementary components of light — or photons — into a molecule at one time.

He designed and developed a unique vacuum UV flash lamp used in laser studies.

He headed a scientific team that in 1979 pointed a telescope in a satellite orbiting the earth toward a comet and then used lasers in the laboratory to study the light patterns emitted by some of the molecules present, enabling the team to gather new information about that comet.

He is now gearing up another research team that will utilize a similar investigative approach to study the inner regions of the most famous comet of them all — Halley's Comet — which is scheduled to appear in 1985-86.

Since January 1976, research projects he has initiated in laser chemistry and astrochemistry, the study of the chemical processes that occur outside the earth, have attracted grants totalling some $1.8 million to the university from the Department of Energy (DOE), the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF) and the Office of Naval Research (ONR).

At present, Jackson and a Howard colleague, George Walrafen, head research teams that are supported by a $964,470 ONR contract. Under the contract, Jackson's team is pursuing studies in photodissociation, Walrafen's team in Raman spectroscopy, another branch of laser chemistry. The funds have made possible the construction of a new laser chemistry laboratory to be housed in renovated quarters behind Freedman's Square. Scheduled to open sometime in the spring, the facility will enable the two research teams to house all their complex (and expensive) equipment under one roof.

Through the years, Jackson has authored or co-authored some 50 articles explicating his research in such publications as *Chemistry,* the *Journal of Chemical Physics, Science, Icarus, Nature* and the *Journal of Photochemistry* and has delivered scientific papers before conferences in various U. S. cities and in France, Germany, Greece, England and Canada. He is now organizing a major laser chemistry conference which will bring scientists from all over the country and from several foreign countries to the Howard campus in May.

Parallel to Jackson's work in pure science has been his role as a leading crusader for greater minority access and participation in the sciences. He originated the concept of the NSF's program of resource centers for science and engineering, designed to enlarge the pool of minority scientists and engineers, and served as the centers' principal advocate before various Congressional subcommittees. He also has promoted the interests of minority scientists by serving on various panels and committees of scientific organizations and government agencies, by consulting with private industry and by writing on the important role Black colleges and universities have played in producing Black scientists and engineers.

Both his advocacy and his research have earned him numerous honors in recent years, among them the Distinguished Service Award of the National Organization of Black Chemists and Chemical Engineers, Howard's Sigma XI Chapter Percy L. Julian Research Award and a designation from the Graduate School of Arts and Sciences as Outstanding Teacher and Researcher.

Neither Jackson's reputation as a scientist nor the honors that have been bestowed upon him have caused him to tone down his strong and sometimes controversial views one iota. Consider, especially his views on why we need more Black scientists.

But first, some NSF statistics. . . .

Item: Blacks today make up about 12 percent of the nation's population, but they represent only about 1.6 percent of the 5
nation's scientists and engineers at all degree levels.

Item: In 1978, the nation's scientists and engineers in all fields totalled 971,654. Of these, only 9,906 were Black. In the more specialized category of "physicists/astronomers," for instance, the figures were even more startling, with only 80 Blacks counted in the whole country, compared to 25,223 whites and 1,210 Asians (and Asians constitute only some 2 percent of the total U. S. population).

Item: in 1973, of the total number of men and women in the U.S. holding science doctorates, a little less than 1 percent (.9 percent) were held by Blacks. Six years later, that percentage had scarcely budged. (It was 1.1 percent.)

What such statistics show, of course, is a dramatic underrepresentation of Blacks in science and engineering. They show something else, too: the situation doesn't look like it will improve significantly anytime in the near future.

It's statistics like these — and their consequences — that motivate Jackson to don his campaigner's hat. "True economic development in any American community requires that it have complete access to the most advanced technology," he testified at a 1976 Senate subcommittee hearing on the NSF budget. "To deny the minority community full representation in science and engineering will doom it to second class participation in the future development of America."

Not surprisingly, Jackson believes that "science is one of the most important things Blacks can pursue." And he backs up this assertion with some characteristically strong views:

"I think we delude ourselves into believing we can make substantive changes in the overall well being of Black people in fields like sociology because all we're doing under those circumstances is studying the symptoms or the effects of what has happened to our people as a result of years of oppression and discrimination. But, looking at it from a practical business point of view: there is no market for sociological research on Black people — other than Black people. To do sociological research is to be shunted off from the mainstream because you are not supplying anything the majority population wants. In the long run, unless you have something to barter with your oppressors, you have no way of ultimately being free."

For this reason, Jackson says, he thinks sociology is "a waste of time" for Black folks. Then he takes back his words—sort of. "That's too harsh a statement," he concedes. "Sociological research is important. But it's still not going to make any substantive changes."

James Scott, chairman of Howard's sociology and anthropology department, disagrees. He believes Jackson's views on this are "rather narrow—to say the least." "We need the social sciences to identify the distinctions in the social structure that make for and perpetuate inequality," he insists. "Without knowning what the problems are we're unlikely to come up with remedies. I agree that we need more Blacks in the hard sciences and I share his [Jackson's] hope that we can achieve a greater balance. But we shouldn't jump on the social sciences as if they were the culprit. We need them all — the physical sciences *and* the social sciences."

If the social scientists don't agree with his views, Jackson says, "That's o.k." And he continues to pound away at his argument:

"Any Black person who is sensitive at all feels he has to do something about improving the status of Black people. In the '60s sociological research and the social action agencies looked like they were really going to accomplish something.They were like a siren call, attracting some of the brightest Blacks in the country. Then, when they recognized a lot of the problems are financial, they said 'we need more Black businesses.' Well, you can't make a Black business on sociology. You make a Black business on producing something the rest of the world needs.

"Look at the Fortune 500 companies. They manufacture things. They manufacture technically oriented things for the rest of the world. Now you cannot compete in that kind of society unless you have some kind of technical skills to compete in that society."

Taking note of the dismal Black representation in the hard sciences, Jackson continues, rhetorically, of course:

"We don't have any scientists! We don't have any engineers! We therefore don't have any of the creative, innovative technology that you need to compete in that society. It's ludicrous to me to think about how we talk about aiding the Third World and we don't have the skills to aid the Third World. We're one of the largest Black populations in the world in one of the most technically advanced countries in the world and we don't have any skilled people to export. We have very few engineers who can go over and build an oil refining plant in Nigeria or who can prospect for oil in the Ivory Coast — because nobody has been trained! So what these countries are required to do — and what everybody is required to do — is to fall back on getting white help to develop their countries."

Jackson's usual foghorn voice actually seems to leap a few octaves as he continues:

"White people, in reality, don't believe Blacks can do science. Remember, as you said earlier, science is supposed to be 'hard,' 'difficult.' Well, if Blacks could do science that would fly in the face of whites' preconceived notions about what the Black intellect is. Suppose, if instead of the percentage of Black Ph.D's in science being of the order of 1 percent, it was 20 percent? That would have to contradict whites' inherent disbelief in the equality of Blacks. Now, whether they would face that contradiction is their problem. But the contradiction would be there and it would make some of them uncomfortable. More importantly, from our point of view, is that the contradiction would be there for all to see so that *our* children do not feel inferior. For ultimately I believe it is what we [Black people] feel about ourselves that is more important than what they [white people] feel about us."

Why are there so few Black scientists? Jackson cites such reasons as the relatively small number of Black people, in general, who pursue graduate education; the fact that so many Black students attend colleges and universities which have historically produced few Black scientists; the small number of Black role models in science; and, most importantly, the low academic expectations met by Black students from kindergarten on. As he puts it: "The main problem that Blacks have going into science is convincing people that they *can* go into science."

"Too many teachers and counselors — and some of them are Black too — don't perceive that Blacks can go into science," he says. "They don't perceive their students are as smart as they are. They don't expect anything of their students—after all, people in prestigious institutions have told them their students can't learn—and the students respond by not doing anything. Then, in the '50s there was this big thing in the major teachers colleges about 'why should we be training everybody to be an academician?' and 'it's important to maintain the student's self worth by making sure he doesn't feel bad when he flunks, so let's pass him on to the next grade.' What this led to was a gradual deterioration in the performance level of all students—not just Black students. But Black students could least afford this kind of deterioration."

So what's the way out of this mess? Jackson has no revolutionary answers. Just plain old common sense: "The first thing I would like to see is teachers getting back to teaching people how to count, how to add and subtract, how to read. And then we must require *everybody* to take more science. It's ludicrous that we don't. If a student can read, can write and can do mathematics at an acceptable level—and I'm not even talking calculus here—he is a good candidate for science. There's no mystique about it at all."

Trying to influence a large bureaucracy like a public school system to do some thing concrete about teachers' low expectations of Black students and giving a higher priority to science education can often be frustrating, Jackson acknowledges. That is one of the reasons the NSF-financed resource centers he has championed — which aim to encourage more Blacks, Hispanics and American Indians to pursue science — were designed to operate independently of any public school system. To date centers have been established in New York City, San Juan, Albuquerque and Atlanta (based at Atlanta University.)

Through the Atlanta resource center, for example, elementary schoolchildren attend special Saturday enrichment activities in science; teachers at regional colleges have attended national scientific conferences and been able to purchase and repair needed research equipment; a Ph.D. program has been launched in chemistry and a master's program in physics.

These are definitely steps in the right direction, Jackson believes. Still, he grouses, "The centers have been funded to such a low level that it's ludicrous." Jackson had originally proposed that each resource center be funded at $6 million a year. The funding that was actually approved for each of the four centers amounts to $2.8 million for a *four*-year period.

Aside from setting up special programs such as (adequately funded) resource centers and pressuring the nation's public school systems to mend their ways, Jackson cites another way to increase the nation's pool of Black scientists: supporting and strengthening the nation's Black colleges and universities. Despite their financial problems, he points out, Black colleges and universities *have* proved that they are particularly effective in producing Black scientists and engineers. Amongst all the gloomy statistics, he has written, these institutions "offer a ray of hope."

He cites one U.S. Bureau of Education report which notes that in the 1975-76 academic year, 42 percent of all the science bachelor degrees awarded to Black students were awarded by Black colleges and universities. Yet these institutions enrolled only 18 percent of the Black student population at the time. He cites, too, the experience of his own bailiwick: In chemistry, alone, Howard has produced 124 Ph.D's, 80 percent of them earned by Black Americans, and it only has been offering the degree since 1954.

Jackson did his own undergraduate work at Morehouse and has been a Howard faculty member for seven years. From the vantage point of one who has experienced being on both sides of the classroom in a Black educational institution, he attributes the relative success of Black colleges and universities in turning out Black scientists not to facilities but to attitude: "See, white people's attitude toward making it to the top is that if you make it to the top, fine. If 10 percent are frustrated, so what? They have enough trained people so they don't have to worry. They don't have to maximize the potential of every one of their students. But we don't have that luxury. We cannot afford to destroy any of the human potential that we have available and it seems to me that that is what Black colleges recognized a long time ago and that's what they tried to do.

"We do it, frankly, by coddling our students more than they would be coddled at white institutions. By coddling, I don't mean we lower standards. That is not the case, or it should not be the case. We must challenge our students to be as good as they possibly can. We must not let them 'get over.' We must make sure that they do what they have to do. But that does not mean that we cannot try to recognize that they have problems and be sympathetic and open to listening to them."

With his own students, Jackson is tough. Consider the scene at a recent graduate seminar he teaches on spectroscopy. [Spectroscopy is a discipline of physics and chemistry devoted to the study of atomic and molecular structure. One of the 1981 Nobel prizes in physics was awarded to a scientist who has made major breakthroughs in this area.] "It's important to recognize that when you're looking at the spectrum you don't have any identifying labels," he noted, speaking to five students in the faculty lounge of the chemistry building. "You have to get the feel for what happens to the spectrum when you change the electronic configuration."

As the seminar moved along, words and phrases like the "Born-Oppenheimer approximation," "diatomic molecules" and "naturally occurring triplets" flew through the air. So, too, did questions: "Why is the spin decoupled from the orbital angle of momentum of OH?" "What do we mean by the corresponding united atom approximation?" "There are two ways of constructing a molecular orbital. Which way is correct?" And another question: "Does this make sense?" It did to the students in the room.

At one point he departed from the topic of the day to have one of the doctoral students in physics clarify a point. At the close of the involved dialogue that ensued, he turned, little boy grin on his face, and remarked: "See, I learned something. That's what I like about a smart class."

The respect Jackson shows for his students seems clearly reciprocated. Victor McCrary, a doctoral candidate in chemistry and a member of Jackson's laser chemistry research team, gives this assessment of his mentor: "He pushes us hard. Keeps on us all the time. He wants us to go beyond being mediocre chemists. He wants us to be great chemists."

Jackson's own mission as a teacher is simple: "I try to impart information. I'm sure all teachers try to do that. But I also try to get my students to understand you've got to work very hard if you want to accomplish anything."

While he obviously relishes his role as a teacher, teasing his students as much as scolding them, it was a desire to do research that motivated him initially to come to Howard.

And that brings us to that third campaign: the campaign to clear away some of the fog of ignorance about the workings of the universe. For is that not, in essence, the mission of the scientist?

How did Jackson become a scientist? First of all, by deciding there was no reason he couldn't be a scientist. "As long as I could remember I wanted to be a scientist," says the Birmingham (Alabama) native. His father, a high school automechanics teacher, and his mother, a radio station program director, encouraged his interest. At first he was enamored of paleontology, then astronomy, then mathematics, then chemistry. "I think I got interested in chemistry," he says, "because it was a challenge. I just like challenges! Then when I got to Morehouse College I ran into this [chemistry] instructor (Dr. Henry McBay) who had a reputation for being very difficult and that made it even more of a challenge. (Of McBay he has written: "His teaching and example of doing research, despite the enormous obstacles he had to deal with, deeply affected each one of the students with whom he came into contact.")

After receiving his B.S. in chemistry from Morehouse, he left Atlanta for Washington, D.C., to study at Catholic University, earning his Ph.D. in physical chemistry in 1961. He then worked as a chemist for the National Bureau of Standards and the Martin-Marietta Company, was a visiting professor in the physics department of the University of Pittsburgh and was a senior chemist at Goddard Space Flight Center.

He originally became interested in lasers as a tool for chemical research. For with the advent of tunable lasers in 1960 were born new possibilities for unveiling some of the mysteries of chemistry. As an article in a special November 1980 issue of *Physics Today* noted: "Laser light provides the most precise and controllable means available for studying the nature of chemical bonds, perhaps the most central question in all chemistry."

While there are considerable variations in laser types, a basic laser device consists of an energy source, such as a flash lamp; a material that fluoresces (gives off light), such as a ruby crystal, a gas or a colored liquid; and a resonator in which light is amplified by stimulated emission, that is by pumping light so full of energy that some light particles (photons) escape, freeing others as they do. Forming the ends of the container or rod holding the laser material are reflecting mirrors, one of which is often transparent.

When the flash lamp is activated, the laser material gives off light, that light is amplified, it hits the mirror and is reflected starting what is called a photon avalanche which produces the laser beam.

Light from a laser differs significantly from ordinary light. Light from a lightbulb, for instance, spreads out in all directions. It is made of electromagnetic waves oscillating at a hodgepodge of frequencies, with the waves suggesting a chaotically milling crowd. Laser light is coherent, that is, it oscillates at only one electromagnetic frequency and its waves have been compared to a column of soldiers all marching in step. Not only does this make laser light the most brilliant light on earth; it also makes it the most powerful light on earth. A laser beam is more powerful per unit wavelength than the sun.

At Howard, Jackson supervises laser studies he describes this way: "We are using laser techniques to investigate just what happens to the small fragments that are produced when a molecule is broken apart by a photon. A photon is an elementary component of light." Putting it another way, he says: "We shine light on molecules and break them apart and look at what happens. And we use lasers to determine what happens."

The "we" of his explanation includes the members of his research team: a junior faculty member, Joshua Halpern, with whom he has written many scientific papers; a postdoctoral fellow; four graduate students; one undergraduate student; and, as of December, a visiting scientist from the People's Republic of China, one of several Chinese scientists now pursuing research at Howard.

Jackson himself spends less and less time in his lab these days. Most of his time is spent in that cluttered office analyzing the data gathered by the members of his research team under his close supervision and writing papers explaining its significance.

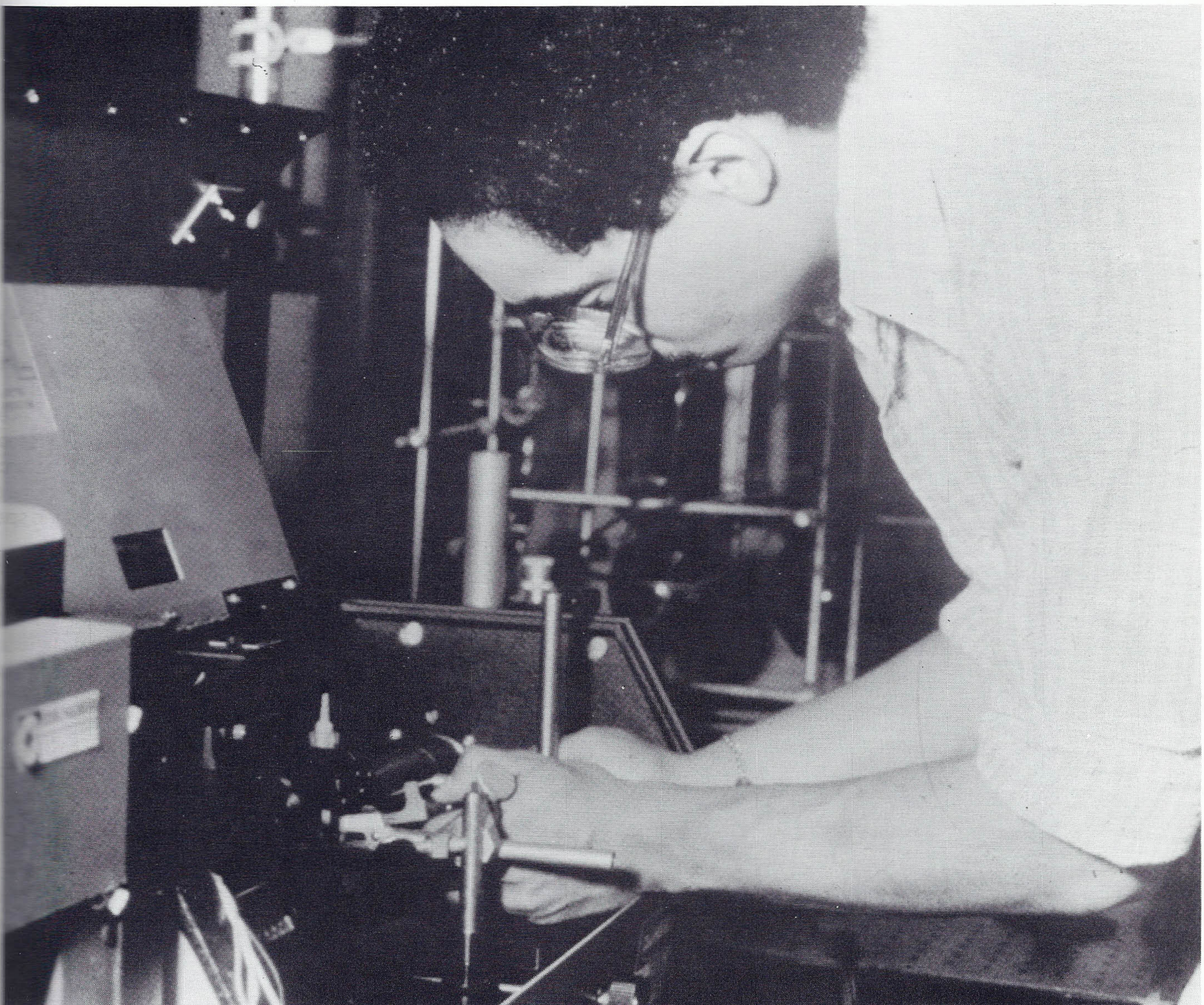
The centerpieces of the lab are the six rectangular boxlike lasers themselves, including one that bears a $75,000 price tag. There are two basic types of lasers represented — gas and tunable dye — and each produces a laser beam in a slightly different way. It's impossible to see some of the actual laser beams, though, because they are in a range of the spectrum that is invisible to the naked eye. Still, when a white paper is placed near where such a beam has been activated, an ethereal-looking brightness shines on it.

The lasers are being used for several related research projects in photodissociation (again, the breaking up of substances by light) and Jackson takes some time out to describe one of them in detail and speak of its significance:

"We are looking at the reaction of carbon atoms, which occur in flames, with what is called NOX. You've probably read about how NOX pollutes the atmosphere and ruins the ozone layer. NOX really means any nitrogen-oxygen containing compound. The practical application of this kind of investigation is that if we understand the chemical reaction between carbon atoms and NOX we can better design combustion systems so that we don't send the NOX into the air.

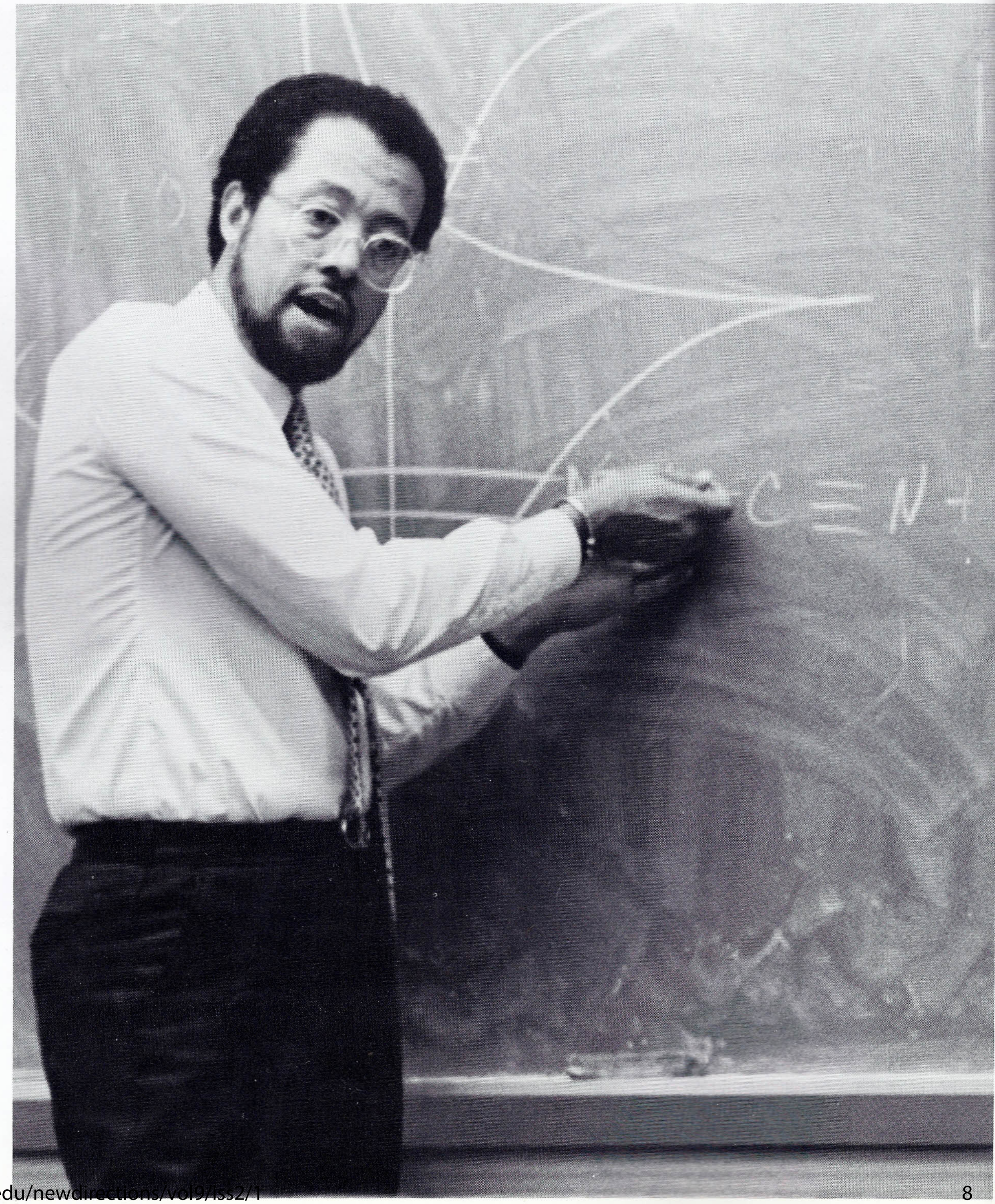
"To do that we have to know what those reactions are. That entails beaming the laser light in a cell to probe the products that are formed from the carbon atoms and the NOX that is present. One of the products that is formed is the CN radical. (A radical is an unstable molecule with an unpaired electron; it's one of the reactive intermediates that occur in most chemical reactions.) So we're looking at the reactions of the CN radical with other compounds.

"Since we can shine our laser light on the CN radical and that CN radical emits some light back that tells us exactly what is going on, we can follow what that CN radical does as it reacts in this chemical system. No



PHOTOGRAPHY BY ASKAI MUHAMMAD

Victor McCrary
Repairing a laser



William M. Jackson.

PHOTOGRAPHY BY HARLEE LITTLE

only can we use this information to determine what that CN radical does, but we can measure a rate constant, that means we can measure how fast the chemical reaction is occurring. And this information can help us to design a combustion system — whether it's the internal combustion engine in your car or the furnace in your house — that will be the right size for the job."

While some of the research Jackson's team is conducting *does* have ultimate practical applications in the area of designing combustion systems and controlling pollution, such applications are a long ways off. Basically, Jackson regards his team as doing pure research.

George Neece of ONR, which is currently funding most of the team's research, would agree. "The thrust of most of the projects we support is pure research," he says. "The significance of Bill's research to us is in increasing our understanding of things about the reactivity of molecules in the presence of light. The Navy is interested in light-induced properties." He adds, though, that Jackson's research "has no direct military application."

Still, all this talk of "pure research" does — or can — raise some moral issues. Most of the scientists studying the nucleus of atoms considered themselves to be doing pure research. And then there was Hiroshima and Nagasaki.

Lasers have been used to weld detached retinas and perform other delicate surgery, to cut cloth, drill through steel, even pierce holes in baby-bottle nipples, to produce special three-dimensional photographs (holographs), and to track moving plates of rock along geological faults to help predict the approach of earthquakes. That is just a sampling of the uses being made of these revolutionary inventions. Then, too, there have been articles from time to time about ongoing research by U.S. and Soviet scientists to find ways to use lasers to track down and destroy "enemy" satellites, missiles and military targets, to guide bombs and to produce that ultimate attack weapon: a death ray a la "Star Wars."

How would he feel, Jackson is asked, if something he discovered or developed in the name of pure research were put to some destructive use? "I don't really want to do anything terrible," he says softly, deliberately. "I'm just like anybody else." But Jackson is not naive. He does not believe any scientist can divorce himself totally from the consequences of his research: "I believe in existential philosophy, at least that part of it that states that whatever you do or don't do is making an impact on the world around you no matter how small it is. If everybody ignores an issue that has grave and damaging consequences, they still have a corporate responsibility for those consequences."

There *is* a moral dilemma inherent in scientific research, he agrees. "But the moral dilemma has nothing to do with weapons systems. It has to do ultimately with the fact that whatever you learn has both positive and negative consequences — even those things that you don't recognize at the time may have positive and negative consequences. I don't think what I'm doing has any negative consequences. On the other hand, I don't know. I also don't believe anybody can prevent knowledge from being pursued and if I'm not pursuing it, somebody else will.

"Basically what I try to do is work, teach and involve myself in the hope that the world will be a more rational place."

In his view, science can never be a cure-all for man's problems. "Most of the problems we have in the world have to do not with scientific problems but with problems between people," he says. "We have to learn to deal with each other and our nation has to learn to deal with other nations and other nations have to learn how to deal with each other."

But he also believes that through science man can gain insights that ultimately may help him to deal with these problems: "One of the advantages of doing astronomy, for instance, is that it impresses upon human beings their own mortality. Because you must feel insignificant when you recognize how small the world is that we live on, how strange it is compared to all the other worlds in the solar system, and how insignificant our solar system is compared to all of the other solar systems and the stars and galaxies in the universe — and the number is huge and horrendous.

"That number should make anybody thinking about it really sort of stand back and say 'Why am I acting like an idiot?' or 'Why do I believe that I can destroy what I have and somebody's going to always make it better for me?' It's like a man taking out a well-provisioned boat on the ocean and then wasting all his provisions and ultimately destroying himself. That's sort of the way the human race is. We either have to learn not to do that or we ultimately will destroy ourselves."

So, William M. Jackson is also a philosopher?

"Naw," he protests, "I'm just a li'l ole chemist." □

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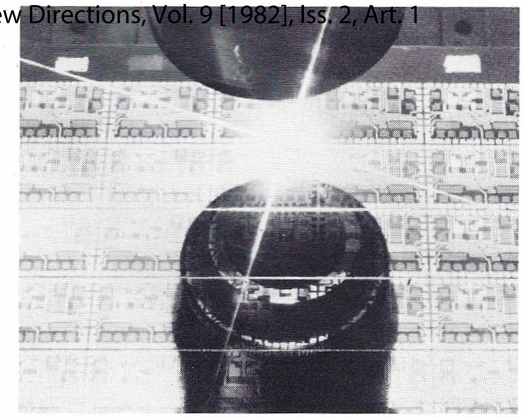
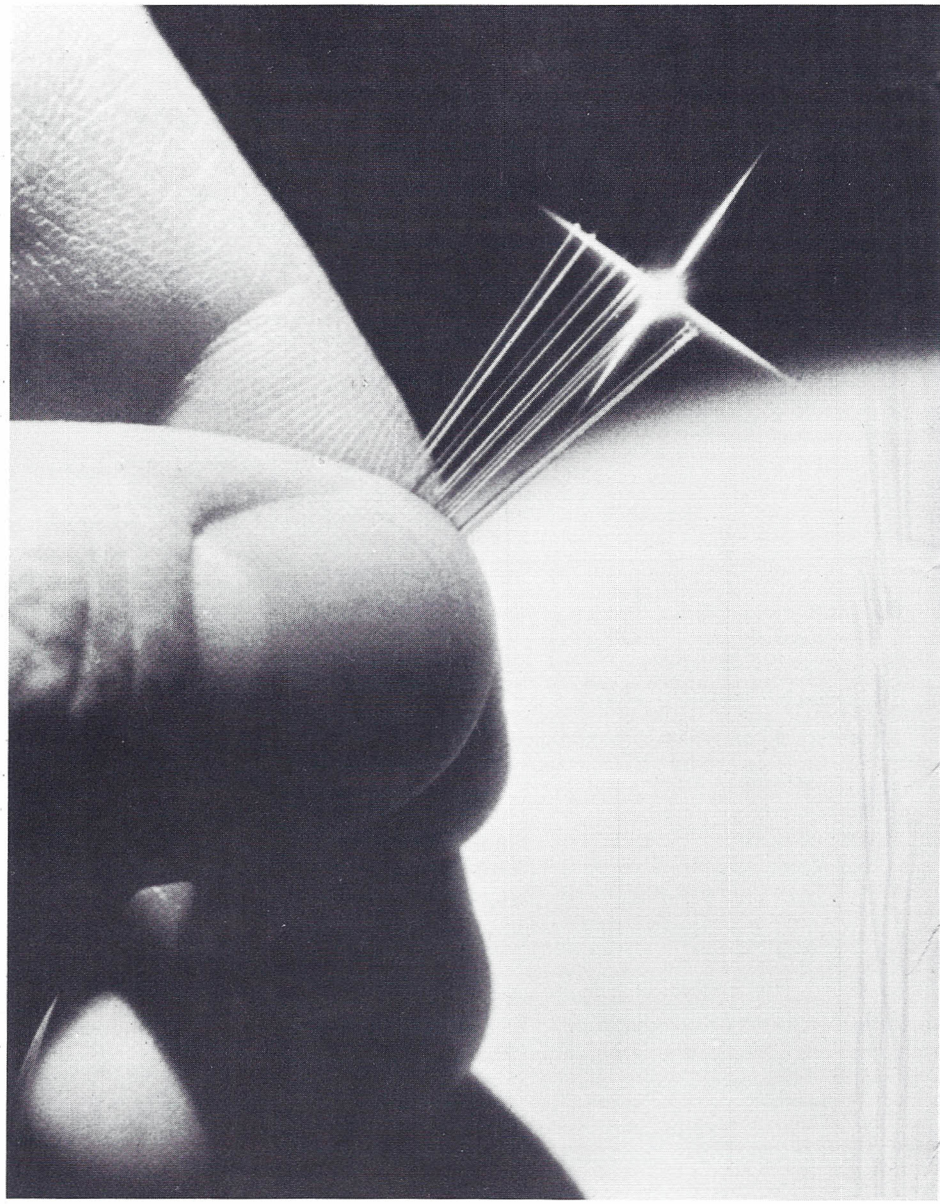
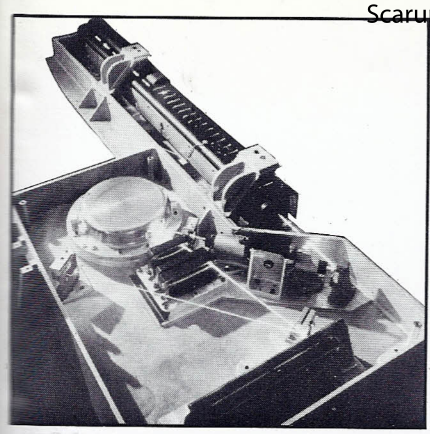


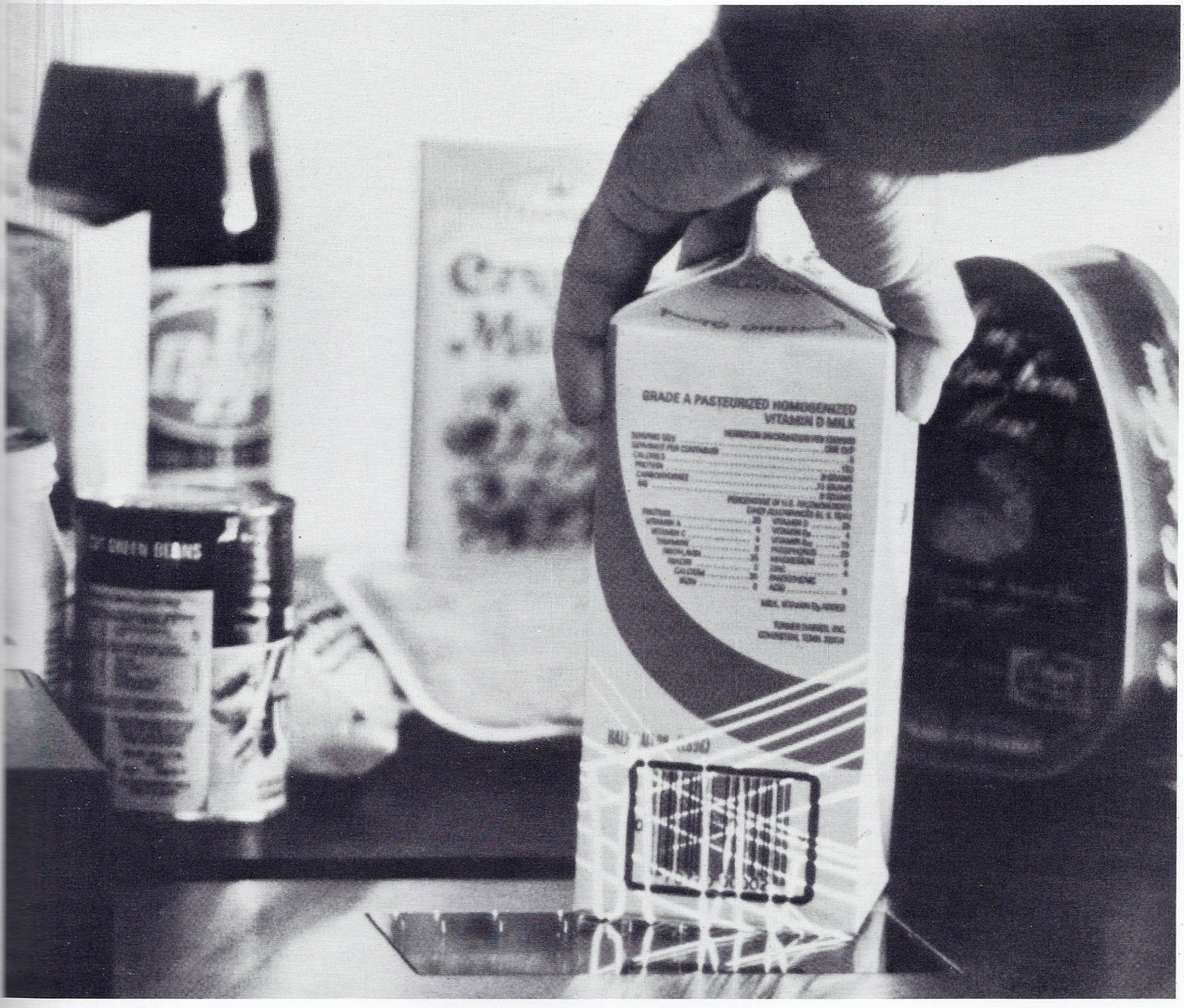
Laser system for use in Touch-Tone telephone.

SOME USES OF LASERS



Lightwave communications system for use in wide range telecommunications.


Laser use in electrophotography for print reproduction.



Laser use in supermarket checkout operations.