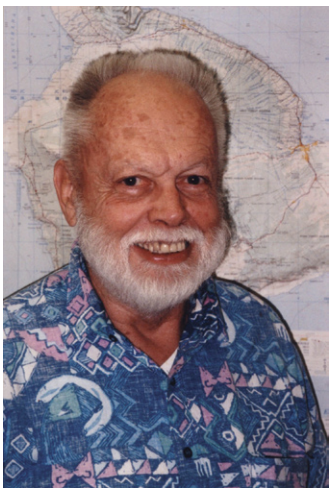
"He had the extraordinary ability to grasp the essence of a physical problem and come up with a simple, cheap, and very effective way to study it."

James A. Westphal
1930 – 2004



Jim Westphal, professor of planetary science, emeritus, whose originality and instinct for designing instruments were legendary, died September 8 at his home in Altadena. He was 74.

Born in Dubuque, Iowa, Westphal spent his early years in Tulsa, Oklahoma, where his accountant father leased a filling station during the Depression. During the war, they moved to his grandparents' farm in the small mountain hamlet of Petit Jean, Arkansas, where Westphal attended school in nearby Morrilton, not much larger. For high school, his parents sent him off to relatives in Little Rock, where he discovered in the library a book on amateur telescope making. He and a friend built an eight-inch telescope and put it on top of the bandstand tower at Little Rock High School. It was the beginning of a long and distinguished career.

Westphal returned to Tulsa and pumped gas for awhile, but, as he recalled in his oral history for the Caltech Archives, he was "hell-bent to go to college." An uncle got him a more lucrative job with a seismic exploration crew, and in a year and a half he had saved enough money to enter the University of Tulsa, where he earned his BS in physics in 1954, continuing to work summers in oil exploration. He never thought that working his way through school was a bad thing at all: "I took a lot of pride in the fact that I could do this all myself."

After graduation, he stayed on with the Seismograph Service Corporation, dropping instruments down into Mexican oil wells for a year, and then joined Sinclair Oil Company's new research lab in Tulsa, where he hung out with other amateur astronomers and with fellow members of the Society of Exploration Geophysicists. It was to this body that C. Hewitt Dix, professor of geophysics at Caltech and considered the father of exploration geophysics, gave a talk in Houston in 1960 on using seismic waves to measure the distance to the bottom of the Earth's crust. Westphal's reaction was: "I bet we can do some of that stuff," and he promptly figured out a simple and clever way of communicating between the seismic waves and the recording equipment. Dix, who could spot talent when he saw it, was impressed and, after spending a summer with Westphal in Tulsa, invited him to Caltech to build an instrument for analog Fourier analysis. Westphal took a four-month leave of absence from his oil job and arrived in Pasadena in January 1961.

Dix also urged him to take a course in applied mechanics from Julius Miklowitz. "He gave me a D+, and I was the happiest man on the face of the Earth." Westphal decided against further education, but meanwhile, his reputation for making clever devices spread quickly beyond geophysics. His scuba-diving pictures, made with a strobe camera he invented, caught the attention of the late Heinz Lowenstam (professor of paleoecology), who used them in his studies of undersea life. (Westphal also figured out that the excessive mortality in Lowenstam's aquariums was due to brass hinges.) Bruce Murray, then a research fellow in space science, wanted to know if astronauts landing on the moon would sink over their heads in a deep layer of dust, and Westphal had an idea how to find out. "A lot of things were happening, and it was all just tremendous," remembered Westphal in the oral history interview. "I was having the time of my life."

Toward the end of the visit, one day Westphal was in Dix's lab "building stuff" when someone came up behind him. "I turned around and said, 'Can I help you?' And he

Westphal works in his lab in 1974.

said, 'Are you worth a shit?' And I said, 'Pardon me?' And he said, 'Do you do good stuff?' And I said, 'Well, some people think I do.' And he said. 'Oh.' And turned around and walked out." It was Jerry Wasserburg (now the MacArthur Professor of Geology and Geophysics, Emeritus). A short 10 minutes later, Bob Sharp, then the division chair of geology, called Westphal in and said, "We want you to stay," offering him a better salary as a "research engineer" than he had been making in the oil business. When he asked what his job was, Sharp told him it was "to decrease research resistance around here." Westphal sold his Tulsa home and never looked back.

Westphal's wide-ranging inventiveness and interests found a fertile field at Caltech, and his background proved surprisingly applicable. For Murray's question, to prove that the astronauts would step out onto luna firma, he rigged up an infrared photometer, similar to one he had built at Sinclair to look for pipeline leaks. For Lowenstam (who also had a background in oil exploration) he built an aquarium that simulated the pressures at various ocean depths (Westphal's experience with oil pumps came in handy). And he developed a Schlieren technique for photographing how water flowed through Lowenstam's ancient shellfish; it was published in *Science* in 1965.

He digitized a quasar spectrum for Maarten Schmidt, now the Moseley Professor of Astronomy, Emeritus, which was published as "Some Astronomical Applications of Cross-Correlation Techniques" in 1965. This was, Westphal said, a technique used in the oil industry all the time: "I was flabbergasted that these people didn't know all about this."

But Westphal didn't just build instruments; he was actively involved in the science that his instruments made possible, particularly in astronomy and planetary science. In the '60s, he published several papers on infrared observations with Bruce Murray (later director of JPL and now professor of planetary science and geology, emeritus) and Gerry Neugebauer, the Millikan Professor of Physics, Emeritus. Over his career he wrote 133 scientific papers.

"What I liked most about Jim," says Neugebauer, "was how much he enjoyed science. He did fun stuff superbly and was interested in the way things really worked. Whatever he did, he saw new applications in totally different fields and was not afraid to try out a new technique or idea."

Murray considered him the "cleverest instrumentalist (if I can create a word) I ever knew at either Caltech or JPL. He had the extraordinary ability to grasp the essence of a physical problem and come up with a simple, cheap, and very effective way to study it."

While working with Barclay Kamb trying to measure the thickness of the Blue Glacier, in Washington, Westphal jury-rigged an oscilloscope with a camera on it to lower into the glacier. He wrote it up as a paper, "In Situ Acoustic Attenuation Measurements in Glacial Ice," which Caltech decided to consider his "dissertation." In 1966 he was promoted to senior research fellow. The next thing he knew, he had been made an associate professor of planetary science in 1971, and by 1976 he was a full professor with tenure—sans PhD.

Rich Terrile (MS '73, PhD '78), now a planetary scientist at JPL, was Westphal's first graduate student. He said (in a profile of Westphal in *Caltech News*, 1995) "It's a real credit to Caltech that they'd recognize intellectual brilliance over academic credentials. . . . Jim is a genius."

Westphal didn't hesitate to apply his genius to practical ends. During the energy crisis in 1973, he suggested removing one fluorescent tube out of each pair in every light fixture on campus and replacing it with a capacitor. He first tried it out in the business services building, coming in on a Sunday and replacing half the tubes with "phantoms." No one noticed. Caltech implemented this scheme campus-wide and cut lighting expenses almost in half. This led to a patent on the energy-saving phantoms and a $10,000 national award for Westphal.

But astronomy was to be his ultimate destiny. He developed silicon sensing devices for Palomar, the first application of such devices in astronomy. When, in 1973, he and astronomer Jerry Kristian fitted his Silicon Intensified Target onto the prime focus of the 200-inch Hale Telescope, Kristian couldn't identify the star field and questioned, "You got this damn telescope pointed right?" Then they suddenly realized that they were seeing stars that were too faint to be picked up on photographic plates. They were seeing "deeper in the sky than anybody had ever seen before," said Westphal in his oral history.

That exhilarating experience made him a convert to silicon. When he got wind of the new silicon detectors (CCDs: charge-coupled devices) being developed at JPL for the Galileo mission to Jupiter, he and Jim Gunn (then at Caltech, now professor of astrophysics at Princeton) desperately wanted "to get our hands on some of those things" for the 200-inch, correctly calculating that CCDs were "going to wipe out every other detector astronomers use" and revolutionize astronomy.

CCDs were at the heart of what was to become Westphal's most widely known achievement—the Wide Field and Planetary Camera on the Hubble Space Telescope. Initially, he was not enthusiastic about working with NASA. When Gunn suggested that they make a proposal to build the instrument, Westphal told him (as quoted in *E&S,* Summer 1990): "You're out of your mind. Neither one of us works in that world; we don't want to spend our time up there dealing with that bureaucracy and counting beans and making viewgraph presentations and not being allowed to make marks on a blackboard and all that sort of stuff."

With Sue Kieffer, Westphal prepares to lower his camera into the steaming mouth of Old Faithful and (below) watches the launch of the Hubble Space Telescope with the late Clair Patterson, professor of geochemistry, emeritus.

Kicking and screaming, he was dragged into the project; Gunn even persuaded him to be the principal investigator of the WF/PC, pronounced "Wiffpick," to be built at JPL. (Gunn and Westphal tested the Wiffpick's design on an instrument for the 200-inch: the "four-shooter," which used similar optics and arrays.)

"The facility with which Jim negotiated the NASA bureaucracy during the construction of WF/PC was astonishing," says Gunn. "I think they had never quite run into anyone like him before; they wanted badly to dismiss him because of his background and lack of pedigree, but were burned almost instantly because of his awesome intellect and deep understanding of essentially all the problems that interested and confronted them. It was impossible not to like Jim, and NASA managed both to do that and have a healthy respect (read fear) of him."

Although the culture and style of a government lab was not to Westphal's liking, to say the least (and vice versa: there were times, said Westphal, when he thought the NASA people would gladly deport all the scientists to Chile and leave them there), the perfect instrument that was born of that collaboration became a hero of our time. Not only did Wiffpick diagnose the spherical aberration in Hubble's mirror, but Wiffpick II was designed as a corrective lens to salvage the near-disaster and made possible Hubble's glorious images of space that have been such a scientific and popular success.

For his 17 years' work (it was supposed to be four) on the Space Telescope, Westphal and his team earned 320 hours of observation time and billions of frequent-flier miles. He and Gunn also achieved their original goal of fitting CCD detectors to the 200-inch Hale Telescope—and ultimately to most of the major ground-based observatories in the U.S. and Chile. Nowadays, the technology is as close to hand as the ubiquitous digital camera.

When he was informed, by phone, in 1991 that he had won a MacArthur "genius" award, he replied "something unprintable, something that meant 'no kidding,'" and then, sensing it wasn't a hoax, "started apologizing all over myself for what I had said." He later "realized it gave me a strange sense of freedom," even though he had always thought that he had all the freedom anyone could ask for. (He once wrote of himself in a short biographical sketch: "His job is his hobby is his job.") After hiding out for awhile, avoiding all committees, he settled on a project.

He had long been interested in the geophysics of volcanoes (after Mount St. Helens blew in 1980, he designed cheap, sacrificable tiltmeters encased in styrofoam pellets and mounted in plastic garbage cans to study its future rumblings.) Geysers were something similar, not to mention being related to his first career dropping instruments into holes in the ground. So Westphal used the MacArthur money to find out how geysers work. Collaborating with geologist Sue Kieffer (PhD '83), he got beautiful data on Old Faithful in Yellowstone National Park, but they were unable to come up with a model of what happens down in the geyser between eruptions. Finally he put a tiny video camera inside a vacuum-insulated housing to keep it cool in the boiling water and lowered it down the crack. The "gorgeous footage" that resulted showed that the pressure from large blasts of water coming in from side vents and fissures was forcing the superheated water up the cylindrical pipe and out the top.

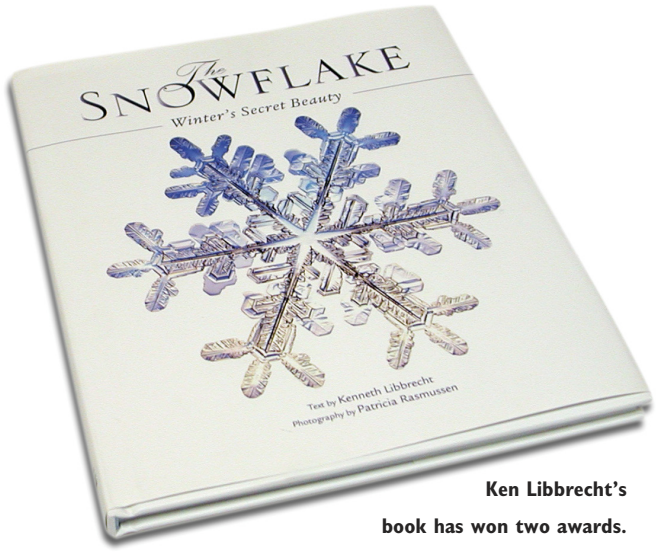
In 1994 Westphal was asked to take on the directorship of Palomar Observatory. He considered it a "service job. It's a job to keep the trains running on time," with no academic responsibility. He agreed with great reluctance to serve for three years, because of his love for the great telescope. The most vexing problem of his tenure was hiring cooks (he finally hired the local Hare Krishnas), and it was with great relief that he relinquished the job to Wallace Sargent, the Bowen Professor of Astronomy, in 1997, before taking emeritus status the following year. He remained active on campus, still "building stuff," until

about a year ago, when a degenerative neurological disease finally made it impossible to continue. But he faced that, too, with characteristic good nature and good sense.

"I think," says Gunn, "the most far-reaching thing I learned from Jim, who was also one of the most fearless people I have ever known, was not to be afraid of anything technical just because of ignorance of the subject or device or any preconception about the difficulty of the task. It is quite OK to deem a task impossible (and he did a very few) but not without knowing how hard it really is."

Terrile, his former graduate student, remembers many nights getting to know Westphal inside the east arm of the Hale Telescope, where "he not only taught me about astronomy and science, but also about more down-to-earth topics like self-reliance, dealing with people, and how to keep focused when things go bad. Jim had a wonderful way of reducing a problem to its most basic form. He said, 'There are always two ways to deal with a problem: You can get angry and upset and then try and fix it, or you can just fix it. Which way would you rather work on it?'"

Westphal is survived by his wife, Jean; a son, Andrew; two stepdaughters, Robin Stroll and Susan Stroll; and two granddaughters. A memorial service will be held December 9 at 4:00 p.m. in Dabney Lounge. □ —*JD*



Ken Libbrecht's book has won two awards.

Honors and Awards

Michael Alvarez, professor of political science, has been selected by the board of editors of *Scientific American* magazine for inclusion in the third annual Scientific American 50, which honors 50 individuals, teams, companies, and other organizations, whose accomplishments in research, business, or policy making during 2003–2004 demonstrate outstanding technological leadership. **Alexei Borodin**, professor of mathematics, received the Prize of the Moscow Mathematical Society for 2003, and **Vadim Kaloshin**, associate professor of mathematics, received the Prize of the Moscow Mathematical Society for 2002.

Clive Dickinson, postdoctoral scholar in astronomy, is the 2004 winner of the Michael Penston Astronomy Prize, given by The Royal Astronomical Society for the best astronomy thesis in the United Kingdom. Dickinson earned his PhD from the University of Manchester and came to Caltech this year.

Charles Elachi, professor of electrical engineering and planetary science, and director of JPL, has received the NASA Outstanding Leadership Medal for "outstanding leadership of the Jet Propulsion Laboratory, whose legacy of excellence in planetary exploration continues with the awe-inspiring Spirit and Opportunity missions to Mars."

Ali Hajimiri, associate professor of electrical engineering, has been named to the 2004 list of the world's 100 Top Young Innovators by MIT's *Technology Review*. Nominees are recognized for their contributions in transforming the nature of technology and business in industries such as biotechnology, medicine, computing, and nanotechnology.

Babak Hassibi, associate professor of electrical engineering, has received a Presidential Early Career Award for Scientists and Engineers for his "fundamental contributions to the theory and design of data transmission and reception schemes." The award "recognizes outstanding young scientists and engineers who, early in their careers, show exceptional potential for leadership at the frontiers of knowledge," and provides five years of grant support.

Leroy Hood, BS '60, PhD '68, visiting associate in biology, became the sixth recipient of the annual Biotechnology Heritage Award at the BIO 2004 Annual International Convention, held June 6–9 in San Francisco. Hood is the cofounder and president of the Institute for Systems Biology, as well as the cofounder of Amgen, Applied Biosystems, and other biotechnology companies.

Ken Libbrecht, BS '80, professor of physics and executive officer for physics, has received a 2004 Benjamin Franklin Award for his book *The Snowflake: Winter's Secret Beauty*. The awards recognize excellence in independent publishing, and Libbrecht's book was honored in the Science/Environment category. The book also won the nature and environment category of the 2004 National Outdoor Book Awards.

Robert Phillips, professor of mechanical engineering and applied physics, has been named by the National Institutes of Health (NIH) as one of nine recipients of the first annual Director's Pioneer Award. The award will provide Phillips, an authority on the nanoscale mechanics of biological systems, with $2.5 million for the next five years as part of the NIH's new "Roadmap for Medical Research" program.

Re'em Sari, associate professor of astrophysics and planetary science, has been awarded a David and Lucile Packard Fellowship for Science and Engineering. Paid over a five-year period, the