I think people don’t have much concept of where we are in history,” says John C. Mather, who has a much better idea than most through his studies of cosmology. “We make plans that are good for a few days or weeks or years, with little thought to what comes far in the future.”

Mather, Senior Project Scientist for the James Webb Space Telescope (JWST), is the recipient of the 2005 George W. Goddard Award from SPIE. He was immersed in science from an early age, with his mother a schoolteacher and his father a researcher in dairy cattle genetics. The books they read aloud to him included biographies of Darwin and Galileo. It was a trip to New York and the Museum of Natural History at age eight that sparked his interest in astronomy.

“We went to see the planetarium show, and we bought a telescope to look at Mars, which was at closest approach in 1954,” he says. “So I was hooked! Needless to say, I didn’t know what it would take to be a scientist, but it was very exciting to imagine.”

Mather is still dealing with things that are exciting to imagine—cosmology and the origins of the universe.

He notes that a key moment in his career came from meeting his PhD advisor, Paul Richards, at the University of California, Berkeley. Prior to that, Mather wanted to be a high-energy particle physicist like his hero Richard Feynman.

In 1974, as a young post-doc at NASA’s Goddard Institute for Space Studies (New York, NY), he proposed a mission, subsequently named the Cosmic Background Explorer (COBE), to make definitive measurements of the cosmic microwave background (CMB) radiation and cosmic infrared background (CIB) radiation.

The proposal to NASA included three instruments, according to Michael G. Hauser, who hired Mather to pursue the project. The Far Infrared Absolute Spectrophotometer was to make a precise measurement of the CMB from 500 µm to 1 cm wavelength and search for the CIB at submillimeter wavelengths. The differential microwave radiometers would search for large angular-scale anisotropy in the CMB brightness, and the Diffuse Infrared Background Experiment would search for CIB at wavelengths of 1 to 240 µm.

“The COBE mission accomplished all of its prime objectives spectacularly well, and yielded major cosmological discoveries from all three instruments,” Hauser writes in his letter in support of Mather for the award. “From inception to final publication, John Mather’s initiative, commitment, scientific and technical brilliance, and leadership were essential.”

“I needed to know something about almost every topic in engineering, from materials properties to cryogenic engineering to mechanical, optical, thermal, and electronic engineering” Mather says. “It’s a lot of fun to try to keep up with and understand the professionals who really make things happen in these areas.”

Now his attentions are turned toward a more massive effort, the JWST. As lead scientist, he has worked with all of the science teams since the project’s inception in 1995 to define the needed observatory capabilities and to imagine future uses for them.
“We had to find that particular combination of scientific capabilities that would match the scientific questions that would be important, and combine that with what might be possible for engineers to build,” he says. “We reached out and said, ‘Build this giant segmented telescope that can be cooled to about 40 K, make it far bigger than the Hubble, and cover infrared wavelengths from 0.6 to 28 µm, and we will be able to do things that no other planned observatory could touch.’” Mather describes his role as “making sure that this grand engineering project really delivers the science that it promises.”

The JWST has recently been the subject of congressional scrutiny, as delays and cost overruns have threatened the size, and perhaps even the completion, of the project. Mather says that “times were tough for the COBE, too.” It had to be rebuilt for a Delta rocket launch after the 1986 Challenger explosion. “Also, COBE was so close to impossible that a constant give and take with the engineering team was required every day as we worked to find solutions to new problems.”

The scale of the JWST is another challenge—it’s “way bigger and I can’t keep up with everybody,” he says. But one significant change from the COBE days is that engineering drawings that once had to be done with pencils are now created and simulated in the computer before a project is built.

Mather looks forward to building on the knowledge that COBE and subsequent research efforts have accumulated. “We’ve got a pretty good measurement of the present quantities of dark matter and dark energy, but we don’t know much about their history, or about extrapolating our future,” he says. “We have plenty of explanations and predictions about them, but we have to decide which might be right. At the moment we are in the classical condition that ‘we need more data.’”

Mather sees studying our origins in space and time as an important look ahead. “Astronomers say we have another two billion years before Earth is too hot to live on,” he says. “If we could begin to engage this question, we might be guided to a suitable stewardship for our planet, and it might look a little different from the plans that are being made today.”

AWARD WINNER PROFILE

Catching a Wavefront

oemagazine checks in with Bahram Javidi, recipient of the 2005 Dennis Gabor Award.

Internationally known and respected, “a leader,” “pioneering achievement,” “most accomplished in the field”—these are just a few of the phrases repeatedly used by his peers to describe Bahram Javidi, recipient of the 2005 SPIE Dennis Gabor Award.

Featured previously in SPIE’s oemagazine (see April 2003, p. 30), Javidi recalls he was initially drawn to the field of optics because of its diverse nature. “I got interested in optics because it’s the combination of so many interesting disciplines,” Javidi says. “It has mathematics, physics, statistics, and then into that you bring electrical engineering for more systems applications and so on. It’s also an enabling technology; you can apply it to communications, information processing, and security systems, for example. And in terms of research, there is more ground to be broken.”

Javidi’s research interests range from image recognition to 3-D TV and video, and from applications of optics in encryption to optoelectronic systems for bacteria recognition. He received the Dennis Gabor Award in recognition of his many contributions to diffractive wavefront technologies.

“In the last several years, I, along with my research team and collaborators, have been working on 3-D image sensing, 3-D image processing and 3-D image recognition, 3-D image visualization, 3-D image fusion, and 3-D display. We have looked at both holographic techniques as well as multiple perspective imaging systems. These systems have many
applications in commercial electronics, the computer industry, defense, and medicine," Javidi explains. "Diffractive wavefront techniques, including holography, which was invented by the Nobel laureate Dennis Gabor, are some of the major cornerstones of the research activities in our field.”

Javidi received his BS in electrical engineering from George Washington University (Washington, DC) in 1980 and his MS and PhD from The Pennsylvania State University (University Park, PA) in 1982 and 1986, respectively. He began teaching at the University of Connecticut (UConn; Storrs, CT) in 1988 as an assistant professor in the department of electrical and systems engineering and is now a distinguished professor of electrical and computer engineering there. Over the years, he has supervised more than 80 MS and PhD students, post-doctoral students, and visiting professors at UConn.

Javidi is not only a Fellow of SPIE, but he is also a Fellow of the Institute of Electrical and Electronics Engineers and of the Optical Society of America. He has chaired or co-chaired many conferences for all three societies including more than a dozen SPIE conferences.

In 2004, Javidi was named the Board of Trustees Distinguished Professor at UConn, the highest honor to be bestowed upon a faculty member. Also in 2004, he became a member of the Connecticut Academy of Science and Engineering. He is currently an alumnus of the Frontiers of Engineering of The National Academy of Engineering.

Regardless of his personal achievement, Javidi shares his success with colleagues of the present and past.

"I am very honored to have received the Dennis Gabor Award and to be in the company of so many great scientists who have won this award," Javidi says. “I have collaborated on scientific projects with almost 100 colleagues. I would like to emphasize that, while I cannot name them all here, I am truly grateful for their contributions to my career and their important role in receiving the Gabor Award.”

MEMBER NEWS AND ANNOUNCEMENTS

Thienpont, Yzuel Receive Society Awards

The President’s and Directors’ Awards are bestowed in recognition of outstanding service to the Society. The 2005 awards were presented to Hugo Thienpont and María J. Yzuel at the SPIE Optics & Photonics Symposium, 31 July–4 August in San Diego, CA.

President’s Award
The SPIE President’s Award recognizes unique and meritorious service of outstanding benefit to the Society and to the optics community. The 2005 President’s Award is presented to Hugo Thienpont (Vrije Universiteit Brussel, Belgium) for his remarkable service to SPIE.

His leadership with Photonics Europe and a willingness to work with SPIE to continue to build this event deserve recognition. His chairmanship of the European Presidential Advisory Committee and service on other SPIE committees is valued for the perspective and international advice he brings to the Society.

On behalf of the entire Society, the President’s Award recognizes and thanks Thienpont for his exemplary service to the SPIE community; his dedication to excellence and quality; and his important contributions to SPIE and the entire technical community.

Directors’ Award
The SPIE Directors’ Award is presented in recognition of significant services of outstanding benefit to the Society. As such, the 2005 Directors’ Award is presented to María J. Yzuel (Universitat Autònoma de Barcelona, Spain) for her outstanding service to the Society in many areas.

Her time spent as a member of the Board of Directors served SPIE well and provided an important international perspective and knowledge along with her timely advice and support.

Her willingness to continue to serve on SPIE committees along with her ongoing participation in international optics-related activities, including serving as the SPIE representative to the International Trieste System Advisory Group (TSOSA), which works to advance optics in developing countries, and her long-standing history with the International Commission for Optics is invaluable.

As an outcome of her tireless commitment and dedication, the Board would like to recognize her continued involvement and applaud the commitment Yzuel has shown SPIE, as well as her many contributions to the optical engineering community at large.
After more than 40 years as the Optical Sciences Center, the research and education facility has a new name and a new degree.

The University of Arizona (UA; Tucson, AZ) established the College of Optical Sciences in April, and beginning this fall semester, the new college is offering a unique program: the MS + MBA dual degree. The two-year degree will earn graduates a Master of Science in Optical Sciences and a Master of Business Administration.

“We just negotiated an agreement with Changchun University in China where, via our distance learning courses, we will teach them 11 optical sciences courses,” Wyant says. “We are very excited about the future of distance learning.”

Students are located around the world, but the college works especially closely with the local Tucson optics industry, including an Industrial Affiliate Program, in which more than 50 companies participate. Feedback from these companies indicated an increasing need for business training.

Thus, the MS + MBA dual degree was created in conjunction with the UA’s Eller College of Management, featuring more flexibility within the MS portion of the program than the regular MS in Optical Sciences and preparing graduates for business and entrepreneurial ventures in optical design and engineering. For example, the dual degree doesn’t require a master’s thesis or report. Instead, students complete an Eller College MBA summer project. If students wish, they can “cross-credit,” substituting two business courses for two optics courses.

“We have had several spin-off companies, and several companies have started offices in Tucson so they could hire our graduates,” Wyant says. “Hopefully, as our program continues to grow, the Tucson optics industry will continue to grow.”

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- Newport Corp. awards travel grants to students presenting papers at Optics & Photonics and Photonics West.
- Sarun Sumriddetchkajorn receives the 2005 ICTP/ICO Award.
- Students gather for the International Student Conference on Development in Optics and Photonics in Riga, Latvia.
- Ozan Cakmakci, a graduate research assistant at the University of Central Florida, receives the 2005 Michael Kidger Memorial Scholarship in Optical Design.
After observing the need for transcontinental collaboration in laser science, the National Laser Centre (NLC) of South Africa formed the African Laser Centre (ALC) in 2003. The program uses funding, networking, and seminars to encourage research collaboration between African researchers and institutes.

Though the ALC was launched in November 2003, this year has seen the program’s most significant activity to date. An important step in the ALC’s development this year was its designation as a Section 21 Company, or a not-for-profit entity, by South Africa, where the ALC is based. This allows the ALC to operate with full autonomy and form public-private partnerships. It also helps the organization attract international donors. The ALC is steered by a board of directors lead by chair Phil Mjwara of the Council for Scientific and Industrial Research (Pretoria, South Africa).

There are currently eight active transcontinental collaborations supported by the ALC. These projects touch on different areas of laser development and research, including studying laser-solid interactions in fluid media, laser-induced plasma spectroscopy, laser-induced fluorescence, photonic crystals, and the design and development of CO₂ gas lasers.

In February, the ALC hosted its first technician training course covering practical and theoretical components of laser technology. It was held at the University of Stellenbosch in South Africa. Technicians from across Africa who attended the course were either already supporting laser research or considering future support.

“We had to turn away most of the applicants due to limited space—and budget—so a second course is definitely needed,” says ALC spokesperson Hardus Greyling. “Over time we will develop the courses to address more targeted audiences. For example, we plan on having dedicated technician training on how to maintain and run laser systems, with the ultimate aim of installing such systems in their institutes’ laboratories.”

The NLC also hosted a lecture series earlier this year at the University of Zimbabwe (Harare, Zimbabwe) on behalf of the ALC covering the theory and practical aspects of lasers.

“In the practical module, eight students actually built their own N₂ laser, learning the basics of laser technology in the process,” Greyling says. “The NLC contributed all the components for 10 complete systems, and each student had to do the calculations, testing, and assembly themselves. The end result was not only that several MSc students learned first-hand what a laser is, but also that the department ended up with 10 working lasers, which they now use for their research and open days, thereby encouraging even more students to come into laser science.”

As for future plans, additional ALC courses are in the works as well as more NLC lectures. The largest projects, however, are a femtosecond initiative and a joint U.S.-Africa educational event.

The femtosecond initiative is a planned coordination of femtosecond systems located in various African laboratories that all African researchers can share. Though the initiative is in the early planning stage, Greyling explains the next step is to invite international experts working with femtosecond lasers to share their research in a one- or two-day workshop.

Further along is a planned 10-day educational event to be offered by the ALC in association with the University of KwaZulu Natal (Durban, South Africa) titled “U.S.-African Advanced Institute in Photon Interactions.” The event aims to engage young scientists from Africa and the United States in an intensive course on laser-related topics; share knowledge that may not be covered in standard laser-related courses; provide networking opportunities that could lead to future collaborations; and identify facilities for future collaborative research projects.

Alfred Msezane, of Clark Atlanta University (Atlanta, GA), and Sekazi Mtingwa, of Harvard University (Cambridge, MA),
Optics East to Feature Sensors, Communications, Life Sciences

Optics East, set for 23–26 October in Boston, MA, spans several scientific disciplines, user communities, and continents in its three technical symposia comprising 25 conferences.

Topics of the Sensors and Applications symposium will include chemical and environmental sensors, biosensors, fiber optics, photonic crystals, nanosensors, water and agricultural monitoring, industry and manufacturing, and robotics. The Communications/IT Com symposium will focus on research in networks, telecommunications, multimedia and display, nanophotonic materials and devices, and broadband access. The Life Sciences symposium will cover emerging applications for optics and photonics in drug discovery and development, IR to THz technologies, and biosensors.

Optics East also will feature several “must-see” plenary presentations. Mario Paniccia, director of the Photonics Technology Laboratory at Intel, will speak on “Silicon Photonics: Opportunity, Applications, and Recent Results.” Paniccia will provide an overview of research being done at Intel to “siliconize photonics” by developing high-volume, bolt-and-go optical components using standard silicon and CMOS processing with the potential for mass production.

Other plenary topics include “The Importance of Physical Sciences in the Future of Biological Research,” by William J. Heetderks (National Institutes of Health), “Broadband Access and Its Impact on Future Networks,” by Kenichi Sato (Nagoya University), and a special “Trends in 3-D TV and 3-D Display” session by Bahram Javidi (University of Connecticut), Fumio Okano (Japan Broadcasting Corp.), and Jung-Young Son (Korea Institute of Science and Technology) will highlight the most promising concepts, technologies, and systems in the field of 3-D TV/display.

A session titled “Market Analysis, Strategic Insight, and Ideas for Business” will provide valuable market information for product strategy and business planning. Topics will include value, margins, and profit in the electronics supply chain; launching new companies from a photonics incubator; and nanosensor market opportunities and global forecast.

For more on Optics East, visit spie.org/events/oe.

In Memoriam: Jed Durrenberger

J. E. “Jed” Durrenberger, SPIE founder and longtime Fellow, died 25 June. Durrenberger grew up in New York, and after service in World War II, earned a degree in mechanical engineering at New Mexico State University in Las Cruces. In 1951 he went to work at White Sands Proving Ground and helped found the SPIE White Sands Chapter in 1959. He served in several roles in SPIE leadership throughout the 1960s, including SPIE Secretary in 1964–65, and was known as the “unofficial historian” of the Society.


Durrenberger received the Alan Gordon Memorial Award in 1960, the Governors’ Award in 1970, and the Albert M. Pezzuto Award in 1971. He retired from White Sands in 1980.

In recent years, Durrenberger, along with longtime SPIE member Austin Vick, maintained the White Sands Missile Range Photoinstrumentation Museum. In 2004, Durrenberger was inducted into the White Sands Missile Range Hall of Fame.

To learn more about Durrenberger’s life and contributions to the Society, read his founder profile at spie.org/50years.