ENVIRONMENTAL SCIENCE

# Japan Starts to Carve Out Its Place in the World

TOKYO—Sitting among a blue-ribbon panel of scientists assembled recently in Washington, D.C., to discuss Japan's research efforts, U.S. Nobel laureate F. Sherwood Rowland asked his Japanese colleagues to imagine a research plane flying over the sea of Japan to monitor atmospheric nitrogen oxide generated by China's growing fleet of automobiles. Although the pollutants directly affect the air over Japan, chances are the plane would be American, said Rowland, an atmospheric chemist, and the data would be analyzed by U.S. scientists. When, he asked pointedly, is Japan going to put more money into environmental science?

The panel, assembled by the Japanese Society for the Promotion of Science, didn't dispute Rowland's premise that Japan is neglecting environmental research. And each member was quick to offer an explanation, although none was an environmental scientist. Existing environmental institutions are weak and their portfolios are not well defined, said neuroscientist Masao Ito, who heads the Frontier Research Program at the Institute of Physical and Chemical Research (RIKEN). It's hard to attract good scientists into the field, added his boss, physicist Akito Arima, president of RIKEN. Perhaps there are so many unanswered questions that it's hard to know where to begin, suggested Hirotaka Sugawara, director of the National Laboratory for High-Energy Physics (KEK).

Ironically, their criticism comes at the same time that the government is launching several new initiatives to bolster Japan's contribution to environmental science. The Environment Agency, which operates the National Institute of Environmental Studies, is forming a think tank to develop innovative policy approaches to sustainable development and global environmental problems. The Ministry of Education, Science, Sports, and Culture, which funds most university researchers, is drawing up plans for a new interuniversity institute to support interdisciplinary environmental studies. And the Science and Technology Agency (STA) recently announced a new, three-legged program—observation, research, and simulation—to understand and predict global change.

The panel's lack of familiarity with these initiatives, say environmental researchers, stems from the field's low ranking on the scientific totem pole. "There wasn't a single environmental representative on that panel," fumed Keiji Higuchi, a hydrologist at Chubu University who serves on several international environmental committees. One contributing factor is an annual budget, roughly $920 million, that trails those of many other disciplines within Japan and lags far behind what many other countries spend on environmental research. Another is the fact that the community's efforts are often fragmented and rarely involve other disciplines. "Most Japanese scientists aren't aware of what's going on outside their own fields," says Higuchi.

**STA'S GLOBAL CHANGE PROGRAM**

| Category | Description |
|---|---|
| Observation | Data collected by remote-sensing satellites, including ADEOS, and by *Mirai*, a new oceanographic research vessel. |
| Research | Up to 100 new research positions to be created in four major areas: climate change, the hydrological cycle, global warming, and integrated modeling. |
| Simulation | Development of a global climate model based on a grid 10 kilometers on a side. |

SOURCE: SCIENCE AND TECHNOLOGY AGENCY

BACKGROUND IMAGE: NASDA

The STA's efforts, which are the most far-reaching of the new initiatives, are intended to combat these problems. The first thrust is to collect more data through increased observation. Last year, the STA-affiliated National Space Development Agency (NASDA) launched a $1 billion Advanced Earth Observing Satellite (ADEOS) that is already delivering a stream of data on ocean temperatures, greenhouse gas concentrations, and other oceanographic and atmospheric characteristics (*Science*, 23 August 1996, p. 1038). Three more remote-sensing satellites will be launched by 2000 to track tropical rainfall, monitor changes in land formations, and replace ADEOS with a newer model. On Earth, the world's largest oceanographic research vessel, the *Mirai*, this fall will join an already impressive fleet operated by the Japan Marine Science and Technology Center (JAMSTEC) to gather meteorological and oceanographic information (*Science*, 6 September 1996, p. 1341). "A lot of data are becoming available," says Taroh Matsuno, a hydrologist at Hokkaido University in Sapporo.

The second prong of STA's activities is intended to boost the size of the community capable of analyzing this bounty. The Frontier Research System for Global Change Prediction expects to create 50 to 100 new research positions this year and more in future years. The researchers, who will be employed by NASDA and JAMSTEC and work at offices in the Tokyo area, will be on fixed-length contracts, and the entire program will be reviewed after 10 years. The project will focus initially on climate change, the hydrological cycle, global warming, and modeling.

Matsuno, who will head the program when it is formally established this fall, says the Frontier system will provide a welcome employment option for recent graduates who have had trouble finding research posts in environmental science. But this influx of entry-level scientists puts pressure on the program to find enough top-level scientists: "There aren't enough qualified people" for the principal-investigator and group-leader positions, he says.

One immediate source of talent is the overseas Japanese community. Syukuro Manabe, a renowned climate modeler who left Japan some 40 years ago for opportunities in the United States, will fill one of the principal investigators' slots after his retirement this fall from the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey. Other higher level positions are likely to be filled by academic scientists dividing their time between their university and Frontier system duties.

It is also hoped that the Frontier program will tap the talents of foreign scientists through the creation of overseas centers, most likely at the University of Alaska, Fairbanks, and the University of Hawaii, Honolulu. The arrangement will also foster a bilateral U.S.–Japan agreement to work together on climate change research. Roger Lukas, a University of Hawaii climatologist who co-chairs a panel involved in negotiating the details, says the collaboration could provide additional resources to plug holes in current research efforts—for example, the interaction between the El Niño phenomenon and the Asian monsoon, and the related seasonal-to-decadal natural variability in the Asia-Pacific climate.

The STA's third initiative seeks a major advance in global climate modeling by harnessing the computer hardware and software expertise of six of its affiliated institutes and agencies. Its 4-year goal is a whole-Earth climate model looking for variations on a scale

of 10 kilometers. Present models use grids roughly 100 to 200 kilometers on a side, and Manabe admits that the plan is "very optimistic." But Philip Jones, a climatologist at the University of East Anglia in the United Kingdom, says that level of resolution is needed for more accurate modeling of both local and global phenomena. "It would produce fantastic results if it were right," he says.

Despite such ambitious goals, the STA program and the other initiatives are seen as only small steps toward making Japan a major player in environmental science. Matsuno says many more positions are needed for environmental researchers, and Manabe notes that much bigger increases are necessary to bring environmental research spending in line with other R&D programs. One important change, says Higuchi, would be a national framework to coordinate efforts among the various agencies. Such a framework, he says, would give the community greater clout domestically and raise its profile internationally. Armed with such information, Japanese scientists might even be able to give Rowland a good answer to his question.

–Dennis Normile

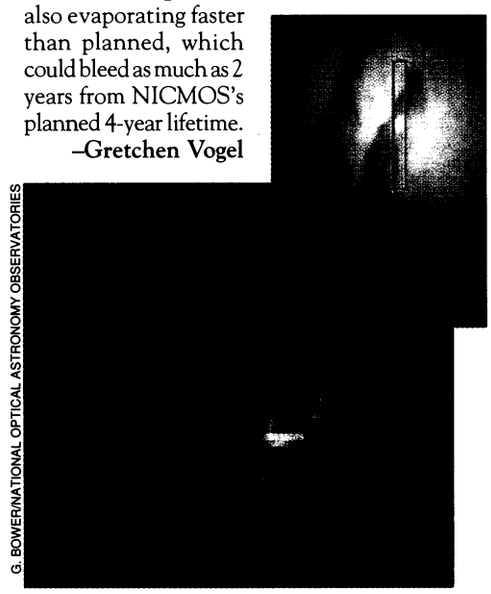
ASTRONOMY

# Refitted Hubble Probes a Maelstrom

This signature of a black hole at the center of M84, a galaxy 50 million light-years away, is an early result from the Space Telescope Imaging Spectrograph (STIS), one of two new instruments installed aboard the Hubble Space Telescope during last February's servicing mission. STIS precisely mapped how light from stars and gas in a band crossing the galaxy's center (upper image) is Doppler-shifted by motion toward or away from Earth. The resulting image—"the best spectrum ever of a black hole," says Hubble project scientist Ed Weiler—shows that light from gas and stars above the galaxy's center is shifted far to the blue end of the spectrum, while just below the center the light is shifted far to the red (lower image). The shifts imply that the gas is whirling around the galactic center at 400 kilometers per second, in the grip of a black hole with a mass of 300 million suns.

Two cameras on the other new Hubble instrument, the Near Infrared Camera and Multi-Object Spectrometer (NICMOS), are also working fine, but a third has been pushed out of focus by an unexpected expansion of its solid nitrogen coolant. The coolant is also evaporating faster than planned, which could bleed as much as 2 years from NICMOS's planned 4-year lifetime.

–Gretchen Vogel



G. BOWER/NATIONAL OPTICAL ASTRONOMY OBSERVATORIES

# New Members of the National Academy of Sciences

The National Academy of Sciences last month announced the election of 54 men and six women as new members.The total number of current active members is now 1773. Academy members also elected 15 foreign associates, bringing the total to 309.

Newly elected members and their affiliations at the time of election are:

**Aizenman, Michael**, Princeton University; **Allison, James P.**, University of California (UC), Berkeley; **Ashcroft, Neil W.**, Cornell University; **Atwater, Tanya M.**, UC Santa Barbara; **Bahcall, Neta A.**, Princeton University; **Beachy, Roger N.**, Scripps Research Institute, La Jolla, CA; **Bennett, Charles H.**, IBM T. J. Watson Research Center, Yorktown Heights, NY; **Cavenee, Webster K.**, UC San Diego; **Ceyer, Sylvia T.**, Massachusetts Institute of Technology (MIT); **Cheeger, Jeff**, New York University; **Chemla, Daniel S.**, Lawrence Berkeley National Laboratory and UC Berkeley; **Cohen, Joel E.**, Rockefeller University, New York City; **Crabtree, Gerald R.**, Stanford University; **Croteau, Rodney B.**, Washington State University, Pullman; **Curl, Robert F.**, Rice University; **Daly, John W.**, National Institute of Diabetes and Digestive and Kidney Diseases; **De Boor, Carl**, University of Wisconsin, Madison; **DeMaria, Anthony J.**, DeMaria Electro-Optics Systems, Bloomfield, CN; **Engelman, Donald M.**, Yale University; **Englander, S. Walter**, University of Pennsylvania; **Freund, L. Ben**, Brown University; **Frison, George C.**, University of Wyoming, Laramie; **Fulton, William**, University of Chicago; **Garruto, Ralph M.**, National Institute of Neurological Disorders and Stroke; **Gimbrone, Michael A., Jr.**, Brigham and Women's Hospital and Harvard Medical School; **Gloeckler, George**, University of Maryland, College Park; **Jencks, Christopher**, Harvard University; **Kay, Paul**, UC Berkeley; **Keen, Noel T.**, UC Riverside; **Kim, Peter S.**, Whitehead Institute and MIT; **Kreps, David M.**, Stanford University; **Lander, Eric S.**, Whitehead Institute and MIT; **Lindquist, Susan L.**, University of Chicago; **Lorimer, George H.**, DuPont Co., Wilmington, DE; **Marcus, Joyce**, University of Michigan; **Mather, John C.**, Goddard Space Flight Center, Greenbelt, MD; **McEwen, Bruce S.**, Rockefeller University; **Metzenberg, Robert L.**, Stanford University; **Miller, Lois K.**, University of Georgia, Athens; **Moore, Peter B.**, Yale University; **Murad, Ferid**, University of Texas, Houston; **Nei, Masatoshi**, Pennsylvania State University; **Nelson, Edward**, Princeton University; **Phillips, William D.**, National Institute of Standards and Technology; **Randall, Linda L.**, Washington State University, Pullman; **Raymond, Kenneth N.**, UC Berkeley; **Schwarz, John H.**, California Institute of Technology; **Smith, Kirk R.**, UC Berkeley; **Söll, Dieter G.**, Yale University; **Stossel, Thomas P.**, Harvard University and Brigham and Women's Hospital; **Tsien, Richard W.**, Stanford University and Beckman Center; **Tully, John C.**, Yale University; **Tumlinson, James H., III**, Agricultural Research Service, Gainesville, FL; **Turner, Michael S.**, University of Chicago and Fermi National Accelerator Laboratory, Batavia, IL; **Tyson, J. Anthony**, Lucent Technologies, Murray Hill, NJ; **Verma, Inder M.**, Salk Institute for Biological Studies; **Wallace, John M.**, University of Washington, Seattle; **Watson, Edward B.**, Rensselaer Polytechnic Institute, Troy, NY; **Williams, Lewis T. (Rusty)**, Chiron Technologies and UC San Francisco; and **Witte, Owen N.**, UC Los Angeles.

Newly elected foreign associates, their affiliations at the time of election, and their country of citizenship are:

**Barenblatt, G. I.**, UC Berkeley (Russia); **Bolin, Bert R. J.**, Stockholm University (Sweden); **Connes, Alain**, Collège de France, Paris (France); **Cory, Suzanne**, Royal Melbourne Hospital, Victoria (Australia); **de la Chapelle, Albert**, University of Helsinki (Finland); **Deisenhofer, Johann**, Southwestern Medical Center, University of Texas, Dallas (Germany); **Dewey, John F.**, University of Oxford (U.K.); **Douce, Roland**, University of Grenoble (France); **Jortner, Joshua**, Tel Aviv University (Israel); **Leggett, Anthony J.**, University of Illinois, Urbana-Champaign (U.K.); **Mas-Colell, Andreu**, Universitat Ponpeu Fabra, Barcelona (Spain); **Nielsen, Ebbe S.**, Commonwealth Scientific and Industrial Research Organization, Canberra, Australia (Denmark); **Polge, Ernest J. C.**, Animal Biotechnology Cambridge Ltd., Cambridge (U.K.); **Reuter, Harald**, University of Bern (Switzerland); and **Simons, Kai L.**, European Molecular Biology Laboratory, Heidelberg, Germany (Finland).

(More information is available online at www.nas.edu/new)