

Light pollution out West concerns optical astronomers

Largely because of very fast population growth in the southwestern United States and California in recent decades, increased sky glow from artificial lighting has come to be an increasingly serious threat to the viability of existing optical observatories and plans for larger optical telescopes based on innovative technologies. Astronomers have successfully persuaded many communities to enact ordinances to curb light pollution, however, and sky glow appears to be stabilizing near some of the nation's major observatories. Astronomers hope that continued efforts may even lead to some reduction of sky glow during the most important nighttime viewing hours.

According to a fact sheet prepared by David L. Crawford, chairman of the American Astronomical Society's Light Pollution Committee, "growth in lighting has been as high as 20 percent per year over a few decades, representing a 40-fold increase in manmade lighting of the sky in 20 years." Light pollution has sharply reduced the capabilities of the 200-inch Hale Telescope on Palomar Mountain, and it was a major factor in the Carnegie Institution's decision this year to mothball the 100-inch telescope on Mount Wilson on 1 July 1985. Robert J. Brucato, assistant director of Palomar Observatory, says that "light pollution from Los Angeles and Pasadena inhibits the use of the Mount Wilson 100-inch telescope in support of the kind of research done by the Mount Wilson staff," which specializes in "very faint extragalactic observation." As a result, Brucato says, staff has found it necessary to concentrate work at Carnegie's Las Campanas observatory in Chile.

Efforts by California astronomers to get something done about light pollution have led to acrimonious confrontations in a number of local communities, especially over the question of whether or not to convert street lighting from mercury-vapor, high-pressure sodium or incandescent lamps to low-pressure sodium lamps. Astronomers much prefer low-pressure sodium lamps because they emit light almost exclusively in



Dramatic increase in light pollution in the Tucson area over two decades shows in this composite photo taken from Kitt Peak National Observatory in 1959 (top) and in 1980 (bottom).

the sodium D lines of the spectrum, while high-pressure sodium lamps emit light over virtually the entire visible spectrum. But the conventional wisdom among lighting specialists and urban planners has been that low-pressure sodium lamps are undesirable because they give poor color resolution.

In 1982, the San Diego city council voted to convert from mercury-vapor to LPS lamps, but the following year it reversed itself and voted 5-4 to replace some 17 000 mercury-vapor lamps with high-pressure sodium lamps. But early this year, after local astronomers mounted an intense lobbying campaign, the council reversed itself again and voted 6-3 in favor of low-pressure sodium conversion. The astronomers cited European and US studies indicating that use of low-pressure sodium lamps does not lead to more traffic accidents or street crime, and they pointed out that the LPS lamps can be operated much more economically than mercury-vapor or high-pressure sodium lighting. Emphasizing the

stake that local communities have in the continued viability of the observatories, Palomar's Brucato used a metaphor that seems to have struck home with some council members. He said that the spectrum from mercury-vapor lights presents an obstacle to astronomers that is like a picket fence; high-pressure sodium lamps are like a solid fence, he said, while LPS lighting is like a fence with just one picket. To reward the city council, Palomar named an asteroid after San Diego this year.

Brucato reports that Palomar and Mount Laguna Observatory astronomers are now getting good cooperation on lighting from all the communities in the San Diego area and have carried their campaign into a second phase involving pressure for a city ordinance that would regulate lighting on commercial property, in advertising and at athletic events. A similar story has been unfolding in San Jose, where Lick Observatory astronomers persuaded the city to convert to a mainly LPS lighting system and require LPS lamps

in all commercial and industrial parking lots. This summer, Lick astronomers held a party at the observatory for San Jose friends to celebrate the resolution of what once were quite unpleasant disputes, according to Lick astronomer, Sandra Faber.

Arizona astronomers, working hard to avoid the acrimony that marked some of California's battles, have persuaded more than 30 towns and counties to pass lighting ordinances. Tucson passed a landmark lighting ordinance in 1972 and revised it in 1981. Phoenix, at this writing, appears to be on the verge of passing an ordinance. Flagstaff, home of the Lowell Observatory and the Naval Observatory Flagstaff Station, has had an outdoor sign and searchlight ordinance since 1958.

The Arizona astronomers have worked especially closely with local businesses, advertisers and lighting engineers to work out consensus solutions to the pollution problem. David Burstein, an astronomer at Arizona State University in Tempe, collaborated with an economist and a lighting-design architect at the university on a survey of lighting practices in 110 communities in the Southwest and an economic report on Arizona astronomy. The main point of the exercise has been to focus the attention of people in Arizona on their economic stake in what Burstein calls the "world's largest collection of research-quality telescopes."

David Crawford, an astronomer at Kitt Peak and chairman of the AAS Committee on Light Pollution, has "infiltrated" (as he puts it) the Illuminat-

ing Engineering Society of North America and serves as chairman of the Society's Committee on Light Trespass. Many IES members have been helpful, according to Crawford. "Everybody worries about being blinded by intense light in the rain," Crawford says, "and nobody likes intrusive light from neighbors." The Arizona astronomers, according to Crawford, have been particularly successful in working with the local billboard industry. The industry resisted shifting lamps from the bottom to the tops of billboards because displays are typically replaced from above. But a compromise was worked out involving shielding of the lamps and time-clocking them, in many cases, to go out at midnight.

Probably the single most important factor in persuading people to adopt better lighting practices, however, has been the push for more efficient lighting. "The energy crunch has been a tremendous ally," Crawford says. The superior economics of low-pressure sodium lamps has been a special blessing, he adds.

The degree to which astronomers succeed in getting communities to grapple with the light-pollution problem could have an important bearing on whether the 15-meter National New Technology Telescope is sited in Arizona or Hawaii. The communities near Mount Graham, the proposed site in Arizona, have passed ordinances. Hawaii has as well, and besides, the observatories on Mauna Kea are protected much of the time by cloud cover below the peak of the mountain on the northeast side of the island. —ws

positions.

The *Graduate Student Survey*, the largest of the AIP manpower reports, contains information on subfields, minorities, and sources of financial support, and it includes a separate section on astronomy. While 921 PhDs were awarded in physics in 1982-83, just 81 students received doctorates in astronomy. By comparison with physics, there were more women and fewer minority students among the graduating astronomers.

The Graduate Student Survey can be obtained free from Susanne D. Ellis Manpower Statistics Division, AIP, 335 East 45th Street, New York, NY 10017. —ws

AAPM chooses McCullough president-elect for 1985

The American Association of Physicists in Medicine has chosen Edwin C. McCullough president-elect for 1985. McCullough will succeed the president for 1985, James Purdy, who is professor and chief of radiation physics at the Washington University School of Medicine.

McCullough was educated at the State University of New York at Stony Brook (BS in physics, 1964), the University of Maryland (MSc in physics, 1967) and the University of Wisconsin (PhD in radiological sciences, 1971). After a year as visiting scientist at the MRC Cyclotron Unit, Hammersmith Hospital (London), he returned to the University of Wisconsin and worked there until 1973, when he joined the Mayo Clinic. He is now professor and head of medical physics in the division of radiation therapy there. His professional activities include serving on the editorial boards of *Radiology*, *Journal of Computer Assisted Tomography* and *Neuroradiology* as well as being the current physics program chairman for the annual meetings of the Radiological Society of North America. He has published widely in therapeutic radiological physics (quality assurance, intraoperative therapy physics) and diagnostic radiological physics (computed tomography) and is particularly interested in the teaching of radiological physics to physicists, technologists and resident physicians.

Jean St. Germain has been elected Secretary of the AAPM. St. Germain has been a member of the Board of Directors and served on various scientific and professional committees of the Society. She is an assistant attending physicist in the department of medical physics at the Memorial Sloan-Kettering Cancer Center and assistant professor of clinical radiology at Cornell University Medical College. The fol-

Education

Larger share of PhDs goes to foreigners

In the 1982-83 academic year, for the first time since the late 1970s, there was an increase in the proportion of foreigners among students earning physics PhDs at US universities, according to the latest AIP *Graduate Student Survey*. The survey results, based on questionnaires sent to graduate students, indicate that the proportion of foreigners earning PhDs increased to about 27% from 24%. Foreign students tend to become theorists rather than experimenters, and because they make up a larger share of the graduate population as a whole, there also was an increase in 1982-83 in the proportion of advanced physics graduate students in theoretical fields.

Starting salaries for persons earning physics PhDs and master's degree improved slightly in 1982-83. Among PhDs, the median salary for postdoc

sincreased 6% to \$1650/month, while the median salary for potentially permanent jobs rose 3% to \$2760/month. The median salary earned by students graduating with master's degrees climbed 5% to \$2250.

Only about 4% of the 1982-83 PhDs received no job offers—roughly the same as in previous years—and 49% of the PhDs received two or more offers. Among the PhDs who got no offers, there were five experimenters for every two theorists—a reversal of the normal pattern. The switch can be attributed to the increase in foreign graduates, who are more likely to be theorists and more likely to accept postdocs without delay because they can remain in the country on student visas. Foreigners took about 10% of the potentially permanent positions in the United States and 30% of the postdoctoral