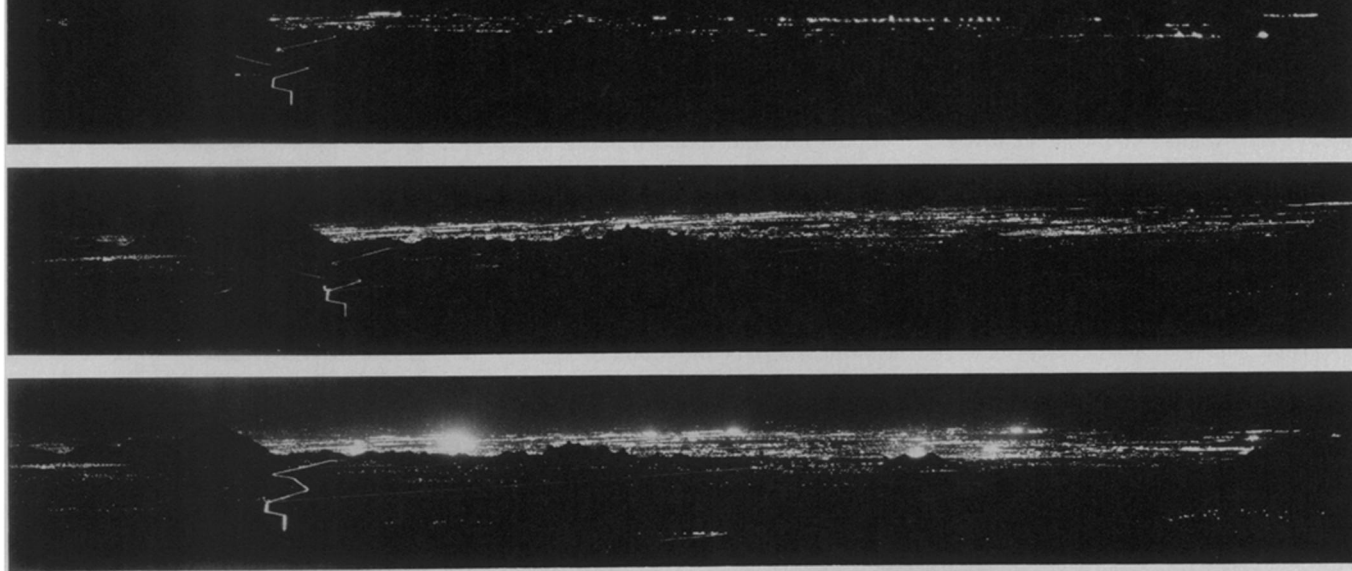


BY DIETRICK E. THOMSEN

Stars and Bulbs over Arizona

The stars may not be able to compete with Candida, the beautiful woman of popular song. She, however, is fiction. The streetlights of Arizona are real, and astronomers are campaigning to lessen that competition.



KPNO

"The light shines in the darkness, and the darkness cannot overcome it." Night views of Tucson taken from Kitt Peak in 1959, 1972 and 1980.

It didn't take a confrontation at the O-K Corral to get Tombstone territory an ordinance controlling light pollution, just a bit of determined lobbying. And never fear; the resulting law is unlikely to dim the neon glitter of the saloons along Allen Street. *Streetlighting* is the main target.

The lobbying for the measure was done by astronomers and their friends as part of a continuing campaign to darken the night skies over Arizona so as to improve observing conditions for the several observatories there. The campaign began some years ago in Tucson and surrounding Pima County. Successes in those jurisdictions led to extension of the campaign to the rest of southern Arizona. Recent months have seen imposition of such regulations in counties and municipalities in southeastern Arizona and at least one municipality in the Mexican state of Sonora. The next target, and possibly a somewhat tougher nut because of its size, is Phoenix and the counties surrounding it.

Astronomy thrives in the dark. Nowadays it needs the dark more than ever. New large telescopes coupled to ultrasensitive photoelectronic sensors provide images of fainter and fainter objects, 22nd, 23rd, 24th magnitude and onward. Not only images, but, what is more important for astrophysicists and more difficult to get, spectra. Success with these extremely faint objects is dependent on an extremely dark background sky for contrast. If too much light generated by earthlings gets into the telescope, such images will be washed out.

It is not possible to make all of Arizona as unlighted at night as Boot Hill, but a good deal can be done to lessen the glare. The effort is led by Kitt Peak National Observatory, the Whipple Observatory, the Multiple Mirror Telescope Observatory and the University of Arizona Seward Observatory. Kitt Peak has retained an illuminating engineer, William Robinson Sr., to contact municipal and county authorities and advise them on ways that lighting systems could be changed. Astronomer David Crawford of Kitt Peak, who is chairman of the American Astronomical Society's committee on light pollution, spends a lot of his time testifying before legislative bodies and talking to civic organizations as do a number of other members of the observatory staffs (especially Dan Brocius of the Whipple Observatory, J. T. Williams of the Multiple Mirror Telescope Observatory and Nicholas Woolf of the Seward Observatory).

The light pollution codes have evolved somewhat since Tucson and Pima County passed the first ones in 1972, says Robinson (SN: 12/15/73, p. 381). Basically they aim at providing shielding for outdoor lighting displays so that most of the light goes downward, having such displays turned off when not in use, and most important of all encouraging the substitution of low-pressure sodium-vapor lamps for the mercury-vapor streetlights that have been so popular in past decades.

Mercury-vapor lamps produce a spectrum that involves five or six colors and imposes itself on astronomical spectra,

wiping out significant portions of them. Mercury vapor also produces a lot of ultraviolet. Ultraviolet astronomy is instrumentally more and more feasible nowadays, and important things stand to be learned from it if it doesn't get washed out. Sodium-vapor lamps produce only one color, basically two wavelengths of yellow, and that is easily filtered out.

Substitution of sodium-vapor lamps is not merely a charge on municipalities, Robinson points out. It is energy efficient and can save money. In California, Lick Observatory astronomers convinced the city of San Jose to retrofit its streetlamps with sodium-vapor bulbs. That is now 90 percent completed, and Robinson cites figures showing that San Jose saves about \$1.8 million a year as a result.

The stepped-up campaign in Arizona began in 1981 when Robinson started in his position with Kitt Peak. The effort was first concentrated in southeastern Arizona, on Cochise and Graham counties and the municipalities in them. The reason, says Crawford, is 11,000-foot Mt. Graham in Graham County. This is a favored site for a 15-meter telescope that Kitt Peak would like to build. Astronomers would like to get protection for it in advance, Crawford says. "If a code is in place now, you can control growth," Robinson adds.

No significant opposition developed, Crawford says. The main problem is public awareness and education. Ted Wolverton, city manager of Willcox, agrees. Willcox, he points out, is a town experiencing rapid growth. In 1970 it had about 2,700 people;

now it has about 3,500. "As long as 200 inches of snow continue to fall in the Northeast," he says, "people will come our way. A town like ours can aid itself as well as astronomers by delimiting light pollution while it is still manageable." It aids itself, he says, not only esthetically but financially. Although the capital cost of sodium-vapor lamps is higher than mercury-vapor lamps, the sodium-vapor variety cost less to run he says. "They use fewer kilowatt-hours." Willcox citizens are also aware of the astronomers' interest in Mt. Graham as a possible observatory site, and the city wants to do what it can to enhance that possibility. If any opposition developed—at least in Willcox—Wolverton says, it concerned certain recreational interests who wanted playing fields lit at night. "We can agree," he says, "that maybe baseball fields ought to be lighted at night. We can also agree to turn the lights off at 11:00 p.m., and thereby also save ourselves some money."

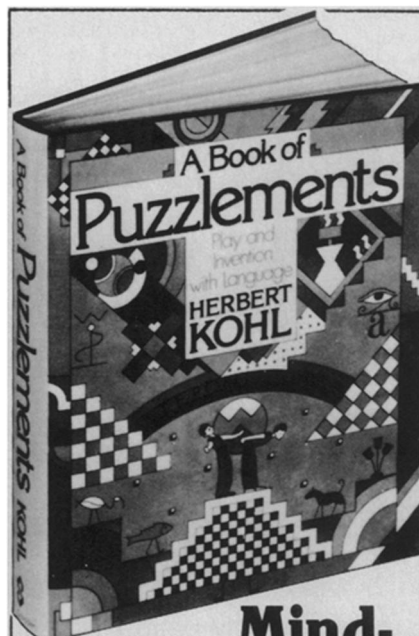
Both Cochise and Graham counties have passed light-pollution ordinances. A number of cities have also done so. Crawford cites Willcox, Bisbee, Tombstone, Benson (almost a roll call of the old frontier). The famous border towns, Nogales, Ariz., and Nogales, Sonora, are on the list by concerted action of their mayors. (Incidentally, Mexican astronomers are planning a large new observatory at Cananea, about 100 kilometers southeast of Nogales.) Most recent effort is concentrated

on Santa Cruz County, Ariz., where the northern Nogales and the Multiple Mirror Telescope are located.

The Phoenix area, because of population and a larger number of administrative subdivisions, represents a bigger problem than any encountered so far. Crawford worries about the cost of the educational effort. So far the money has been "scrounged" from the Kitt Peak budget, but that budget has been seriously cut. There have been a few small private donations, but Crawford would like to find more.

Because of even more concentrated population and a much more complex structure of governmental subdivisions, California is an even more serious light pollution problem. Although astronomers there have had some successes, as in San Jose, their campaign proceeds slower. Hawaii has an ordinance to cover the major observatory sites on the island of Hawaii. There is only "a bit of a problem" yet, Crawford says, in the region around the big observatories in Chile. Texas west of the Pecos, where the Macdonald Observatory is located, seems to be still dark enough to make a lonesome cowpoke sing.

If the Arizonans succeed in the central portion of their state, they will go on to the north so as to cover all of Arizona with light-pollution ordinances. If they accomplish that, it will not be the lights of Tombstone, Willcox or other places—if it is anything—that carves an epitaph for modern astronomy. □



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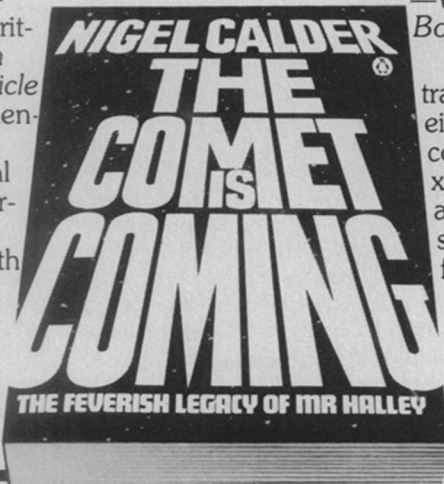
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