

# Light Pollution

# LIGHT POLLUTION -- A PROBLEM FOR ALL OF US

DAVID L. CRAWFORD  
Kitt Peak National Observatory<sup>1</sup>  
Tucson, AZ U.S.A.

**ABSTRACT** Light Pollution is a severe problem for amateur and professional astronomers, and, indeed, for the general public. All these suffer from a lack of awareness of the issues, however. Poor quality outdoor nighttime lighting has several major problems: light trespass, glare, clutter and confusion, urban sky glow, and energy waste. There are solutions to the light pollution problem, most involving the use of better quality lighting. We all must educate our colleagues and the public about the issues, and push for solutions. Quality lighting is compatible with dark skies, and with energy savings. Our view of the universe, as professionals and as the public, and our children's, depends on our being successful.

## INTRODUCTION

This paper will be only a brief introduction to the issue of light pollution. Much more could be said, if time allowed. It is a most important issue, full of many details and subtopics. So the present paper can only be a sketchy introduction to some of the most important issues as I see them.

Have you had a problem with light pollution? Of course! Whether you are a professional astronomer or an amateur astronomer or a member of the general public, you have undoubtedly been bothered by this scourge. Our nighttime environment, for living and for observing, is becoming a mess. There is no good reason for this, and we must reverse the trend.

Your problem was caused by poor lighting; lighting that has:

1. **Light Trespass:** Spill light bothering you; light from a neighbor shining directly onto your observing site, or into your yard. Light trespass is a specially bad problem for the general public, and quite a few neighbors become enemies due to this trespass. It ruins dark adaptation for observers, of course.

2. **Glare:** Bright, troublesome, uncomfortable. Glare is never helpful. It is often a component of nighttime accidents. But people have become so accustomed to bad lighting that they think there is no light unless glare is

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1 . Operated by AURA, Inc., under contract with the National Science Foundation.

present. What a state we have come to when bad lighting is considered good lighting.

3. **Clutter:** Trashy light, cluttering up our nighttime environment, in cities and in the country. It can cause confusion, rather than guidance, adding to the visual litter we so often live in.

4. **Urban Sky Glow:** If you live near a large city, you have lost your view of the universe overhead as seen by our ancestors. This is the special curse for many professional observatories. It brightens the night sky, removing forever the view of the faintest objects. It is a negative for most of the general public too (that includes you and me), those who live in a city. The beauty of the prime dark sky is gone, maybe forever. Those in New York City are lucky to even see the moon. We face the probability that our descendants, in only a few generations, will only be able to see the universe on a screen of a planetarium, or on TV. What a loss for mankind.

## WHAT TO DO?

Building awareness of the issues, and that there are solutions, is the key to success. We must educate. Here are some specific suggestions:

1. If the problem is light trespass, talk to the offender. Ask for their help. Be friendly. But be persistent. Constant push, without making enemies, is usually the key to success. Push in as many different ways as you can. Show how others have helped, and gotten better lighting as a result. We are against bad lighting, we are for good lighting.

2. We must educate people as to what can be done. Most people have no idea about lighting, what is available, what costs are, or anything. Even lighting professionals are often not well informed or knowledgeable about quality outdoor lighting. City staff and governmental officials are not. Most astronomers are not. The public certainly is not. Be sure you are, then go educate others.

3. Educate also about energy waste. Energy savings is one of our major allies. Do you know that we waste at least One Billion dollars annually in this country, through wasted light. Can you prove it to others? Calculate the energy waste for the 175 watt mercury dusk-to-dawn fixture. Lamp plus ballast uses 200 watts, 4100 hours of burning per year, 8 cents per kilowatt hour (national average value), at least 10,000 such lights in the Tucson area, 500 times that in the U.S.A.. At least 30 percent of the light output is wasted (up light, and light at nearly horizontal angles, causing only glare, not useful light). Multiply. And that is just from one type fixture, but one commonly used for street lighting and for "security" lighting. Multiply by 10 to cover the wasted light from other poor fixtures. Amazing, isn't it?

4. Educate about the adverse problems of poor lighting: glare, clutter, light trespass, sky glow, energy waste. Show what quality lighting can do. Push for it. Set a good example.

Here are dictionary definitions for these common words:

*Glare:* Shine with a strong, dazzling light; too bright.

*Clutter:* A jumble, confusion, disorder.

*Trespass:* To go beyond the limits of what is considered right or moral; offend; intrude, encroach.

*Waste:* To destroy; use up; make weak, wear away the vigor of; use up or spend without need or proper return; squander, to fail to take proper advantage of.

*Pollution:* Unclean, impure, desecrated, defiled, contaminated, dirty.

5. Join the International Dark-Sky Association, a non-profit organization recently formed to help. There is strength in unity. Share information. Together we can make a major impact, and educate better locally, nationally, and internationally.

6. Talk to people, individually and in groups. City officials, the media, utility staff, lighting designers, and the public. Develop networks. Build awareness. Push for quality lighting, energy savings, and dark skies. They go together. We need it all.

7. There are not many things in life where the effort to solve the problem can save money. Curing light pollution can save money, makes for a safer, more effective, and more pleasing nighttime environment, and it saves the dark skies.

## SPECIFIC SOLUTION ITEMS

1. Use the right amount of light, not overkill. So often in the past, the "design" idea was that if a certain amount of light was OK, double it (or more) and it would be better. Not so. No professional lighting designer believes that, nor does anyone who considers it with care. One must design and install lighting to meet the task for which the lighting is needed. That's the goal. Not spreading vast amounts of light everywhere. Use the light, don't waste it.

2. Shield the light, so it goes down, not up or sideways. There are many excellent lighting fixtures that control the light output. "Full-cut-off" fixtures are good examples. All the light goes where it is useful. None goes up, and none goes horizontal to cause glare.

3. Use time controls when possible. There is no need to burn parking lot lighting (or billboard illumination) all night, when businesses close at early hours.

4. Use low pressure sodium sources whenever possible; it is also the most energy efficient light source. Use it in good fixtures so that the light output is

well controlled. LPS is a monochromatic light source, so all wavelengths (colors) except that at the sodium doublet lines (in the yellow) are dark. But visibility is excellent for the human eye. There is no color rendering, so LPS is not a good light source for display lots, sporting events, malls, or some other applications, but it is excellent for street lighting, parking lots, security lighting, and many other applications. Where energy saving is critical, LPS should be the choice. Near professional observatories or wherever spectral work is done, LPS should also be the choice.

5. All the above "Solutions" are needed. No one of them will do the job. Which is most important depends on the particular situation. To cure your local observing threat, it may be to get your neighbor's light shielded. To cure the sky glow threat (and glare), it means getting your city's outdoor lighting under control. (Push for a lighting ordinance to regulate outdoor lighting. It does work and is possible. We now have 42 such ordinances in Arizona, covering most all of the populated cities, including Phoenix and Tucson.) For protecting a major professional observatory, it means all of the above, and extensive usage of LPS in the neighboring cities (San Jose, near Lick Observatory; San Diego, near Palomar Observatory; the island of Hawaii, near Mauna Kea Observatory; and Tucson (and the Indian Reservation!), near Kitt Peak National Observatory, all are beginning to use LPS lighting in a major way.)

## SUMMARY

Dark skies are compatible with quality lighting, they require such lighting, in fact. Poor lighting has many adverse effects, including glare, clutter, light trespass, energy waste, and light pollution. None of these are evident when quality lighting is used.

Dark skies are compatible with a safe, secure, and functional nighttime environment. As with astronomers, the public needs and deserves a quality nighttime environment. Glare, clutter, light trespass, energy waste, and light pollution are a major threat to the environment. We can and must stop the threat.

Solutions are possible and they work. Let's achieve them, and have a Win/Win/Win situation: quality nighttime environment, energy saving, and dark skies. You can help. You must, if we are to be successful. We must be successful. Our view of the universe, as professionals and as the public, and our children's, depends on our being successful. The time is now. Let's do it.

*Note to the reader:* Slides and literature illustrating these issues, and the solutions, are available from the International Dark-Sky Association, 3545 N. Stewart, Tucson, AZ 85716 U.S.A. Write for details.