

Challenger
LEARNING CENTER
of Hardin County



The Otter Creek Astronomical Observatory

The Observer

December 2007 (#11)

Evening Programs:

December 15, beginning at 6 PM EST

January 12, beginning at 6 PM EST

February 16, beginning at Sunset

Join the observatory staff for a tour of what is visible in the night sky, including the moon, stars, and planets. *All evening programs are "weather permitting"--if the sky is not clear enough for celestial objects to be visible the observatory will not be open. Evening programs begin at sunset.*

Daytime (solar) Programs:

December 1, January 26, March 1

Daytime programs are "open house" at the observatory. Come safely observe the Sun, with its prominences and sunspots. Walk the model solar system trail and get a sense of the size of things in space. Check out our telescopes and learn about the observatory -- after all, you can't really see what's in the observatory when it is dark. *Daytime programs are held "rain or shine"--the observatory is open regardless of weather. Daytime programs begin at 11 AM Eastern Time.*

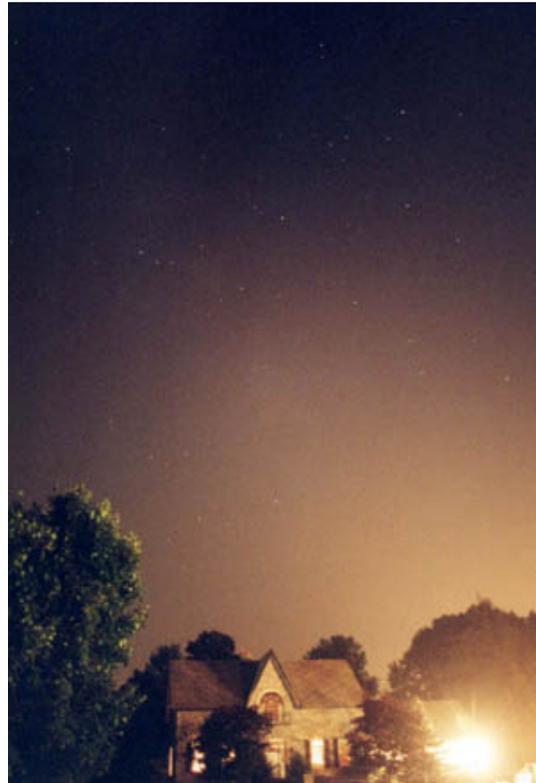
Visit the Otter Creek Observatory web page at

www.ottercreekpark.org

About Light Pollution^{*}

Light pollution is an issue that is constantly a concern to those of us who work at Otter Creek Park Observatory. Light pollution, briefly described, is an excess of generally unwanted light encountered when attempting to observe the night sky. Of course, light pollution isn't an issue when we are only interested in observing the Sun or Moon. Then, we only need relatively clear skies. Unfortunately, light pollution is and has been an increasing problem resulting from urban sprawl and development in even relatively small communities. Much of the US suffers from it since most communities have bright commercial lighting applications that are in service throughout the night. For us at OCP Observatory, we have noted that the development at Radcliff and Fort Knox has generated additional 'sky glow' in a noticeable portion of the sky southeast of the observatory. Since all of Jefferson and surrounding counties stand to benefit from the free public observing programs we offer, this issue potentially affects anyone who would like to observe the stars with us. Few people can appreciate just how awe-inspiring and simply beautiful a truly dark, starry night sky can appear.

To get an idea of how much light pollution can impact our view of the night sky look at the comparison photos below. On August 14, 2003, Toronto, Canada experienced a blackout. These photos were taken on that night and the subsequent night when power



Images from <http://www.aas.org/light/pollution.html>

^{*} By S. Arslanian

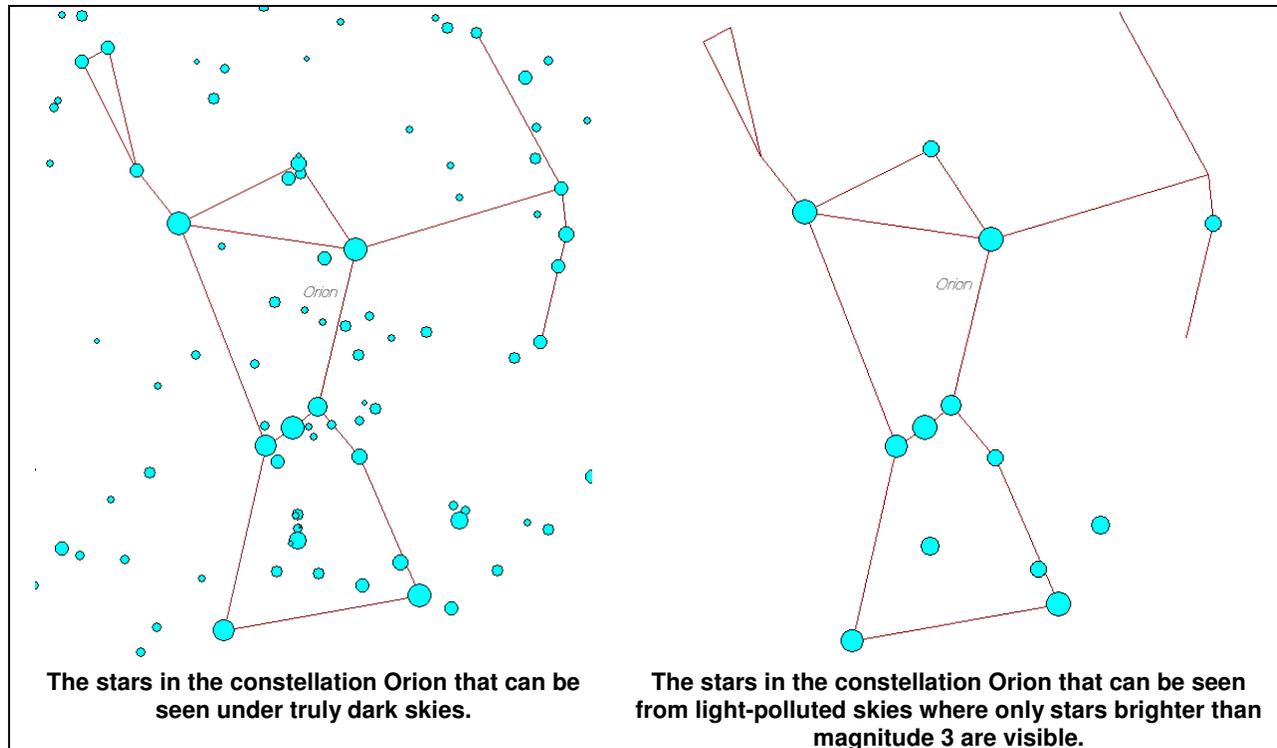
had been restored. The event generated a spontaneous interest in star-gazing and stimulated numerous conversations and impromptu “star parties” as individuals dragged out telescopes and binoculars long abandoned in storage. To drive home the impact of light pollution, consider that these photos were not taken in or even near Toronto, but 45 miles away to the north!

What actually causes ‘light pollution’? Light pollution occurs as a result of artificial light being reflected downward off dust and water vapor in the lower atmosphere. Pictures of the landscape on the Moon show a stark contrast between a bright object like the Sun and the pitch black surrounding sky. If you observed from the Moon, you could see stars in space even while the Sun was up because the Moon has no measurable atmosphere. There is no air with vapor and dust to scatter the sunlight, so the effect would never occur there. Your only concern would be temporarily blindness caused by looking directly at a bright object such as a bright light or the Sun.

Around communities here on Earth, however, the buildup of so much light causes a ‘dome of light’ effect which really hampers observing. Note again in the picture how few stars were visible after the power was restored.

To bring this home even more, when was the last time you saw the Milky Way in your backyard? Did you say, ‘never’? That isn’t surprising since about the best you get in the suburbs is a few of the brightest stars and planets. You miss seeing literally thousands of stars due to light pollution. All those fainter stars are ‘washed out’ by the dome of light effect. In the suburb of a larger community you live inside this dome of light so it is hopeless to expect to see more without physically leaving it.

Magnitude is a measure of ‘brightness’ used with stars, a scale in which the bright stars you see are magnitude 1, dimmer stars are magnitude 2, and so on. Each magnitude represents a 10 times change in brightness. A magnitude 1 star is 10 times as bright as a magnitude 2 star; a magnitude 2 star is 10 times as bright as a magnitude 3 star, and so on. In dark unpolluted skies, with just your eyes, you should be able to see to about magnitude 6 stars. Unfortunately, about the best most people can hope to see in suburban areas are stars down to about magnitude 3. This means that the skies are roughly 1000 times less dark than they could be! You would need to relocate perhaps 100 miles from any community to really get the view of the natural, light-pollution-free sky. For most people, that just isn’t feasible.



There are a number of reasons for public concern with light pollution beyond simply the aesthetic one of being able to appreciate the beauty of the heavens. Two will be addressed here.

First, there is the waste of energy. Most lights are designed to light all around the fixture, not just a particular area. This results in utilizing energy resources like coal to produce wasted light that just goes up into the sky. Efficient designs produce light that shines down on a particular surface and not simply out. Most people don't realize how much it costs to operate a floodlight on a regular basis. A typical 300 watt floodlight left on for 8 hours per night will cost about \$7.20 per month to operate. This may not seem like a lot to some people, but it is for only one typical floodlight – half a dozen or more around a home or business can start to really add up. With a motion sensing light, the cost would probably be under \$1.00 per light, while offering better security because of the surprise factor!

The second issue is actually diminished security. There is some connection with excessive lighting actually reducing security -- more and brighter lighting has been blamed for and associated with increased criminal activity. This should not be surprising since criminals need to be able to see and additional or brighter lighting helps them. A better design might be to include motion sensors since these act as secondary alarm systems alerting police or individuals of unwanted activity.

Consider car dealerships as an example. What is needed is low level lighting shining on the vehicles, not into the sky. But for most dealerships, the lighting applications are excessive for security since the light scatters out and up.

Most of these issues could be addressed with more efficient lighting that costs less and saves energy for business owners and taxpayers, while also preserving the beauty of the night sky. A growing number of individuals are attempting to address this issue with the efforts of interest groups like the International Dark Sky Association. Many amateur astronomers are concerned about the issue of light pollution; some militantly so. Many are involved in groups that actively attempt to change their communities through awareness and outreach efforts to educate the public.

As for Otter Creek Observatory, we have been working to improve lighting in Otter Creek Park so that it will interfere less with the night sky. With better lighting in the wider community the skies above the observatory can stay dark while members of the community save money and energy. There is just no good reason for light pollution.

About Daylight[†]

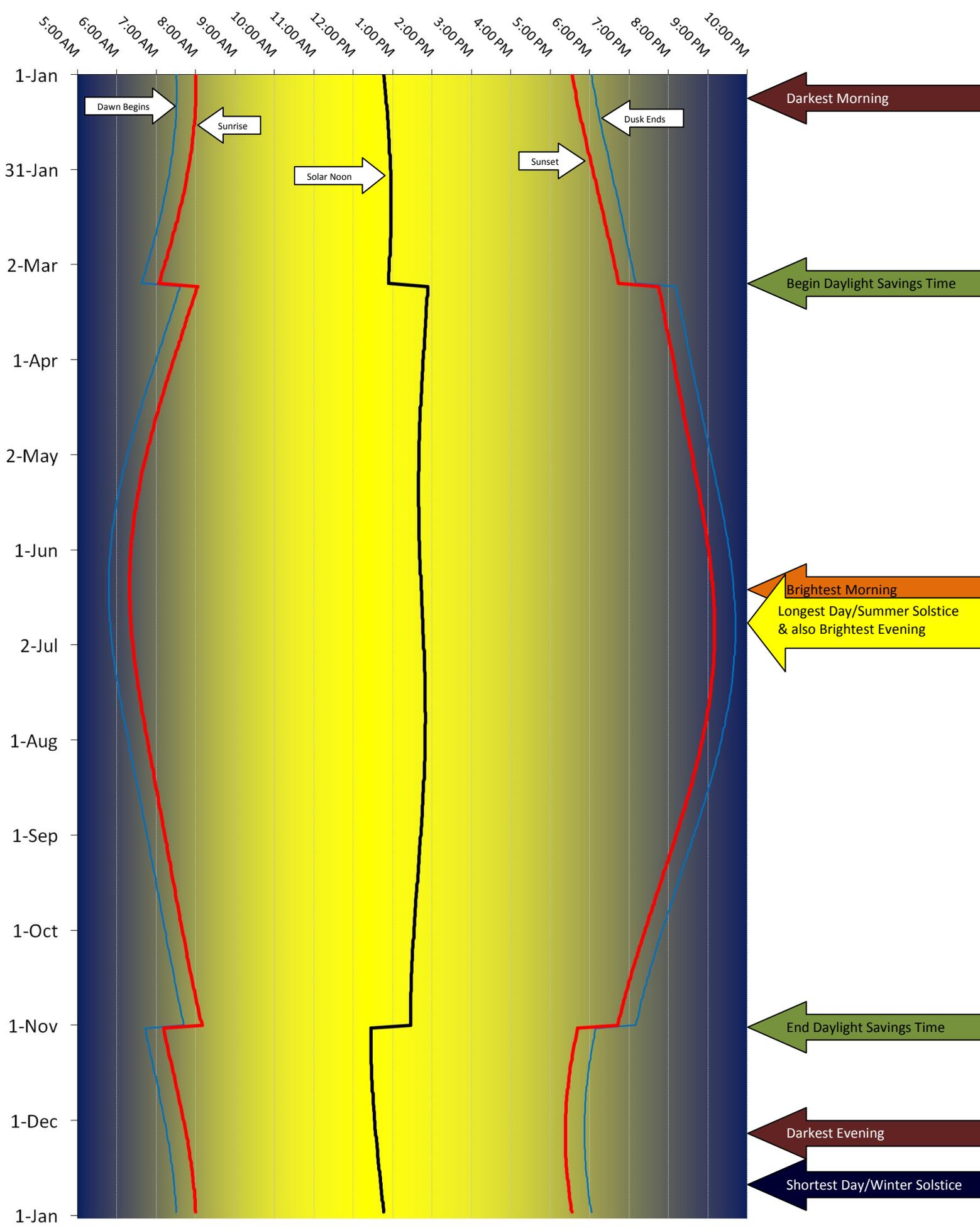
Do you know when the darkest day of the year is – when the days are shortest? If you said “around Christmas” you are correct – the days are shortest near the “Winter Solstice”, around December 22. At the Solstice the Sun is as far south in the sky as it gets, passing directly overhead for people living in countries like Paraguay, Botswana, and Australia. People there see the most daylight of the year, but we here in Kentucky see the least.

Now, do you know when the darkest evening of the year is? How about the darkest morning? Would you be surprised to find out that those do not occur on the darkest day? In fact, the darkest evening (when the Sun sets earliest) occurs in early December, while the darkest morning (when the Sun rises latest) occurs in early January. Why is this? Thanks to a combination of factors such as the Earth’s axis of rotation being tilted relative to the plane of its orbit and the Earth’s orbit being not exactly a circle, over the course of a year the entire period of daylight is shifted forwards and backwards against our standard time, causing the times of sunrise and sunset to be later or earlier regardless of the length of daylight.

On the follow page is a chart[‡] that shows the times of Sunrise and Sunset for Louisville Kentucky for the year 2008. It also shows the time of “solar noon” – or “mid-day” – the time at which daylight is half over. The solar noon line shows how the period of daylight is shifted. For example, the solar noon line is furthest to the right in late July/early August, indicating that the daylight period is shifted toward later hours during that period of the year. Also visible on the chart are jumps in the lines indicating the beginning and ending of Daylight Savings Time. The Dawn line indicates when the sky first begins to

[†] By C. Graney

[‡] Data used in this article come from the US Naval Observatory (<http://aa.usno.navy.mil/data/>).



brighten with morning twilight, and the Dusk line indicates when the sky finally becomes dark.

The chart below, by comparison, shows how the length of the day changes over the course of the year. In the winter the days are shortest, at about nine and a half hours. In the summer the days are longest, at almost fifteen hours. That's a difference of over five hours!

There is a lot of science and math in just simple daylight!

