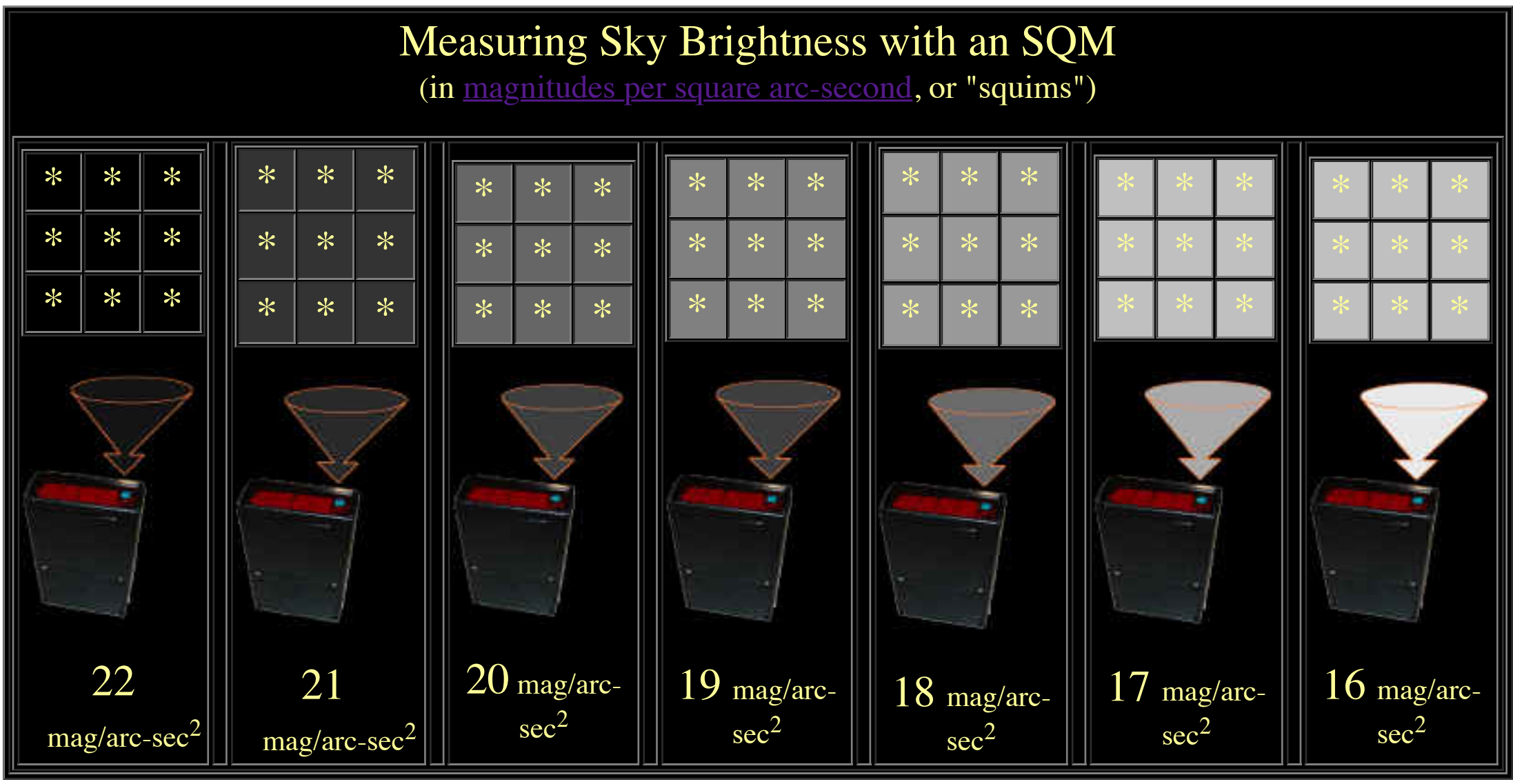
Sky Quality Meter (SQM)

A Sky Quality Meter (SQM) from Unihedron is a hand-held instrument that allows individual observers to quantify the sky brightness. To use the meter, simply hold the SQM overhead while it is aimed at the zenith and press the red button. After a few seconds the unit will beep and a number is displayed. Basically, the *larger* the number the *darker* the sky. A meter reading of 21.00 would indicate a very dark site, while a reading of 16.00 would indicate a degraded, light polluted sky. It's that easy.

The SQM measures how much light, coming in from a cone of sky, strikes a sensor. For older models, the "funnel" is about 80 degrees wide; less than 30 degrees for newer models. The meter then converts that amount of light into units of magnitudes per square arc-second, which are admittedly not easy to visualize. For the purpose of Night Vision, we will create a simpler name for the SQM units, to be called "squims." For example, if the meter reads 18.75 magnitudes per square arc-second, we will describe it as "18.75 squims."

Observers must insure that nearby lights are not within the detection cone of the sensor. Similarly, the light of the moon should not influence the sky's darkness, which is indicated by the Darkness line of a Clear Sky Clock. Lastly, SQM readings should be taken after astronomical twilight, when the sun does not contribute any light to the night sky.



Sample SQM readings paired with a Clear Sky Clock are at:

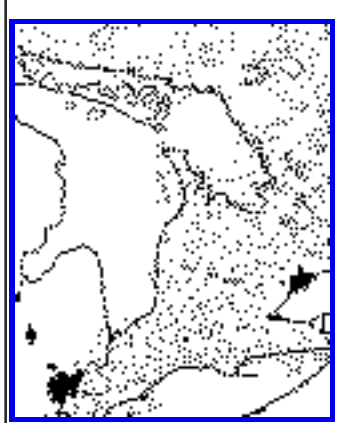
- sqm_data.htm;
- sqm11.htm;
- sqm2006june.htm;
- gumwood.htm;

See also the SQM Database of global measurements ("Suburb back yard, IN").

At magnitudes.htm is more information on "magnitudes per square arc-second," including the excerpts below:

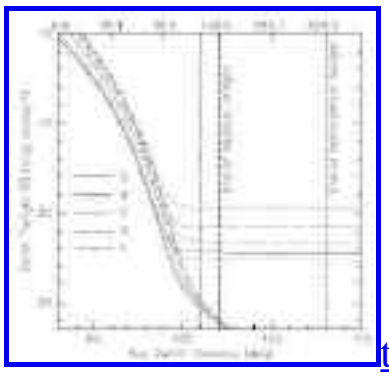
"The practical minimum of the natural background radiation is ~21.6 magnitude per square arcsecond," per authors Kohei Narisada and Duco Schreuder. Source: *Light Pollution Handbook*, page 61.

From http://www.astropix.com/HTML/L_STORY/SKYBRITE.HTM:
How Dark Can the Night Sky Get? by Brian Skiff
"The widely accepted value for sky brightness at the zenith at a site completely free of man-made light sources and near solar activity minimum is: V mag. 22.0 per square arcsecond = mag. 13 per square arcminute. In other words, a perfect site has a sky brightness equivalent to having a mag. 22 star in every square arcsecond box (hardly bigger than the star image itself) over the entire sky."



http://www.rasc.ca/light/print/berry.htm
Light Pollution in Southern Ontario by Richard Berry includes Tables I and II, which describes the appearance of the sky for given SQM values (in magnitudes per arcsecond squared) and suggests an equivalent unit (tenth magnitude stars per square degree) for visualizing magnitudes per arcsecond squared.

From the Journal of the Royal Astronomical Society of Canada, Vol. 70, No. 3, June 1976, Whole, No. 540; reprinted courtesy of Toronto Centre, R.A.S.C.



twilight.htm
Astronomer Ferdinando Patat notes the value in measuring sky glow with an SQM in the late evening *after* astronomical twilight.

From the PHM Clear Sky Clock at http://cleardarksky.com/c/PnnHrMPINkey.html:

Darkness

-4 -3 -2 -1 0 1.0 2.0 3.0 3.5 4.0 4.5 5.0 5.2 5.4 5.6 5.8 6.0

The line labeled **darkness** is not a weather forecast. It shows when the sky will be dark, assuming no light pollution and a clear sky. Black is a dark sky. Deep blue shows interference from moonlight. Light blue is full moon. Turquoise is twilight. Yellow is dusk and white is daylight. For those who prefer numbers, the scale is also calibrated. The numbers are the visual limiting magnitude at the zenith. (The brightness of the faintest star a standard observer can see straight up.) Mouse over a darkness block for details.

It is based on Ben Sugarman's Limiting Magnitude calculations page. It takes into account the sun's and moon's position, moon phase, solar cycle and contains a scattering model of the atmosphere. It doesn't consider light pollution, dust, clouds, snow cover or the observer's visual acuity. So your actual limiting magnitude will often be different.

A. Danko, creator of the Clear Sky Clock, writes:

> "Accurate SQM readings should be had only when the clock's darkness line reads 6.0...The darkness line calculates a theoretical sky brightness that does not consider light pollution. But it does consider the phase of the moon,

altitude of the moon and altitude of the sun...It clearly shows that even a gibbous moon can have very little effect when it is at only a few degrees altitude. The altitude at which a given phase of the moon affects the brightness at zenith varies in a complex way which the darkness model takes into account...While the 6.0 number the "darkness" line calculates for a sky free of scattered moonlight and sunlight is not quite right (mostly because vision varies hugely from person to person), it's a very good indication of when the sky will be at minimum brightness from light from the sun and moon."




An SQM, courtesy of Unihedron, is featured at a light pollution workshop.

www.nightwise.org