

Sky Glow Effects on Existing Large Telescopes For Sky-Limited (Faint Object) Research

In the table that follows, X is the sky glow level. A value of 1.0 designates the natural sky background, without any human contribution; a value of 1.2 means a 20% increase above the natural sky background due to man-made sky glow; 2.0 is double the natural background, and so on.

For a 4-meter Aperture Telescope

X	Equivalent aperture in inches	Equivalent aperture value	Percent of original
in meters			
1.00	4.00	157	100%
1.10	3.81	150	88
1.20	3.65	144	78
1.25	3.58	141	74
1.50	3.27	129	58
2.00	2.83	111	39
3.00	2.31	91	23
5.00	1.79	70	11

For the 4-meter Telescope on Kitt Peak

1.06	3.89	152	93%
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For the 5-meter (200-inch) Telescope at Mount Palomar

2.00	3.58	141	39%
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For the 3-meter (120-inch) Telescope at Lick Observatory

3.00	1.75	69	22%
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For the 2.5-meter (100-inch) at Mt. Wilson Observatory

5.00	1.14	45	11%
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Notes

1. Equivalent Aperture = $\text{LINESPACE } 150 \sqrt{\text{STACK} \{ \{ \underline{\text{Aperture}^2} \} \# \{ X \} \}}$
2. Cost (value) of the facility scales as $\text{LINESPACE } 150 \text{ LEFT } (\{ \text{STACK} \{ \{ \underline{\text{Aperture}} \} \# \{ 4 \} \} \text{ RIGHT }) ^{2.7}$
3. 1990 cost of a 4-meter is about \$10M, of a 8-meter about \$65M, of a 10 meter about \$120M, and of a 16-meter about \$420M. Clearly, the economic loss to astronomy due to any significant amount of urban sky glow is very large.