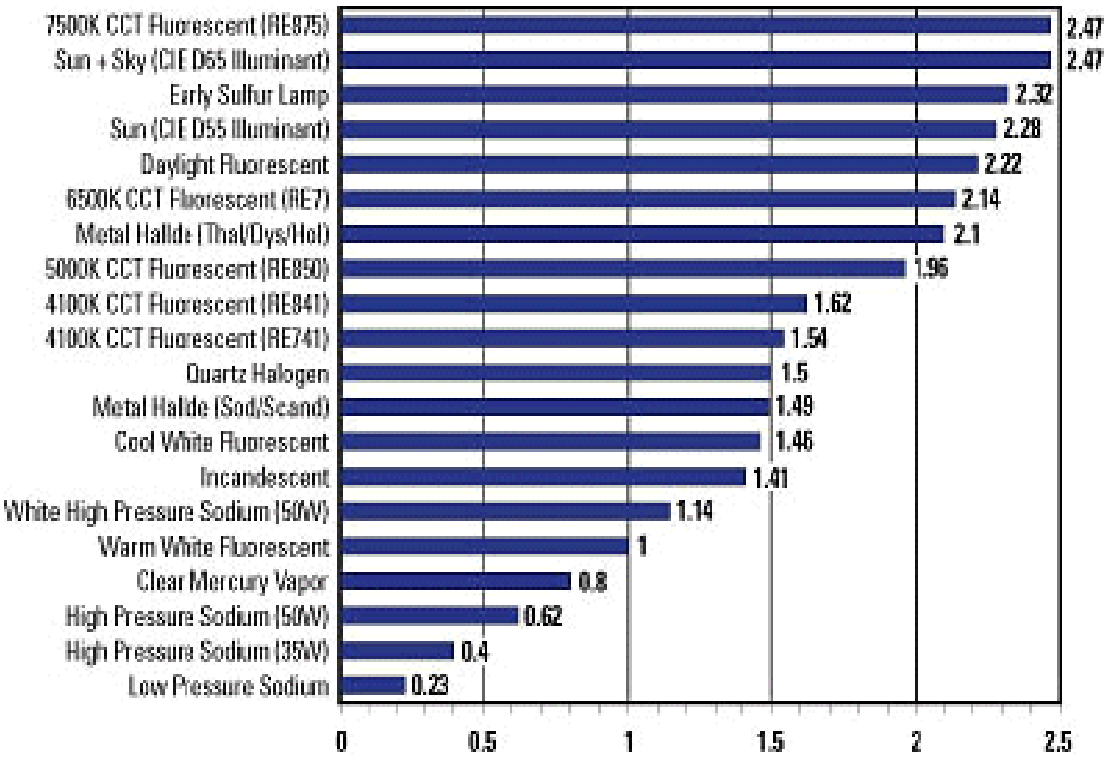
Range of S/P Ratios



Commercially available light sources are available in a range of Scotopic/Photopic (S/P) ratios, but these are often not published by manufacturers, making it difficult for engineers and designers to make use of this performance parameter. Fig. 3

Apply the ratio to the foot candles on the ground for mean visual acuity - the human eye.

Chart and reference by Dr. Sam Berman

Dr. Sam Berman is presently senior scientist emeritus at the Lawrence Berkeley National Laboratory (LBNL). He was the originator and the first leader of the lighting research program. Before joining LBNL, he was professor of physics at Stanford University, where he was a member of the team that founded the Stanford Linear Accelerator.

Application 1.

Ambient lighting also provides task lighting, and Visual performance is important.

In this case, the lighting should be judged on the basis of achieving the clearest vision. Research has determined that the relevant photometric factor is the equivalent pupil luminance or illuminance which is given by the quantity P[(S/P)0.78], where P is the photopic amount and the exponent (0.78) of the S/P value has been determined empirically in laboratory studies.
Consider the comparison of two T8, 32-watt (W) readily available fluorescent lamps costing about the same and with the same color rendering index (CRI) of 85. For this example, lamp A would have a correlated color temperature (CCT) of 3500 Kelvin (K), and 2950 initial rated (photopic) lumens. Lamp B would have CCT of 5000K and 2800 initial rated (photopic) lumens. The choice of lamp is generally made on grounds of luminous efficacy, which favors lamp A. On the basis of the new findings it is the visually effective lumens that should be compared, which means multiplying the photopic lumens by the factor (S/P)0.78.
The S/P value for the lamp A is S/P = 1.4; for lamp B, S/P = 1.9. As a result, lamp B produces more visually effective lumens than lamp A (4619 for lamp B, 3835 for lamp A). In other words, lamp B is 20% more visually effective per watt than lamp A, just the opposite of current wisdom.

Barriers to Application?

It has been more than 13 years since the first studies demonstrating significant rod activity at typical interior light levels along with arguments for major consequences in lighting practice, were published in the Journal of the IES Since then over a dozen papers have been published and many presentations have been made at national and international venues. Except for a few lighting retrofit companies that have adopted the new findings, there is a noticeable lack of mention of these results by the mainstream lighting community. Even a basic property of lamps, namely their S/P value, is absent from the lamp industry catalogues.

Why? Perhaps there is great difficulty in accepting a substantial and sometimes nearly radical change from what has been the standard practice for the entire past century, even though this change is supported by solid scientific evidence. Witness the dramatic example of the computer environment where the relevant photometric quantity needs to shift from photopic to scotopic illuminance.

What is even more surprising is the total absence of any attempts by the small lighting research community to replicate and independently confirm or deny the findings. In other scientific areas there is usually a mad rush to replicate, disprove, or confirm a new and revolutionary result. The only response from this lighting research community has been to either ignore the new results or to claim they are irrelevant.