

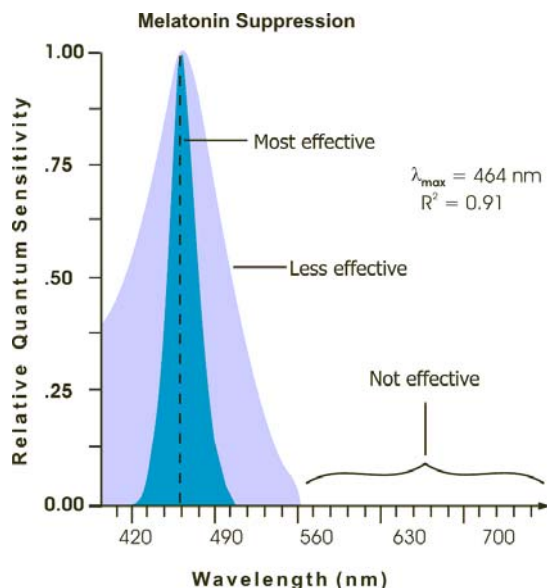
Understanding How Wavelengths Affect Circadian Rhythms

Specific wavelengths shift circadian rhythms while others may be counter productive.

Bright light therapy is recognized as the most effective treatment for circadian rhythm disorders such as Seasonal Affective Disorder, insomnia, mood disorders, shift work, etc¹. However recent studies are showing that specific wavelengths are responsible for shifting circadian rhythms, and when isolated, are twice as effective as multiple wavelengths, full spectrum or white light.² These discoveries also raise the possibility that in addition to being less effective, additional wavelengths may also increase side effects.³

Melatonin Suppression is Key

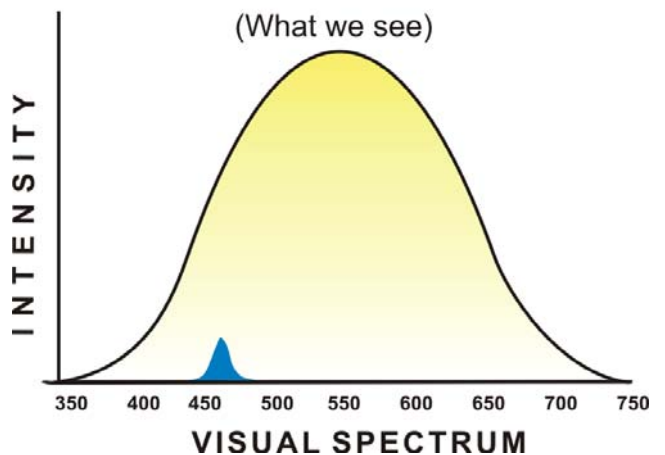
The treatment of circadian rhythm disorders depends on shifting 'out of phase' circadian rhythms back in synch.⁴ Researchers use melatonin suppression to indicate whether rhythms have shifted properly.⁵ In 2001, Dr. George Brainard at Thomas Jefferson Medical University (TJMU) determined that a specific bandwidth of blue light, from 446 - 477 nm and peaking at 464 nm (nanometers) was the '**action spectrum**' or bandwidth responsible for suppressing melatonin.⁶ Subsequent research also identified the range of 400 – 550 nm as having a weaker effect at suppressing melatonin, and light beyond 550 nm as not effective.⁷



Rethinking Light Therapy

For decades, researchers assumed that circadian response was mediated through the rod and cone photoreceptors in the retina of the eye. This was the reason white or full spectrum lightboxes were used; because rod and cone cells respond best to visual, white light. The discovery that a very narrow slice of light was responsible led to the discovery of a novel photoreceptor called melanopsin. Melanopsin has been shown to activate the circadian pathway, and it only responds to this narrow slice of light.⁸ Studies comparing this blue light to traditional light boxes or white LED lights showed blue light to be twice as effective at shifting circadian rhythms.⁹

Photopic Response Curve:

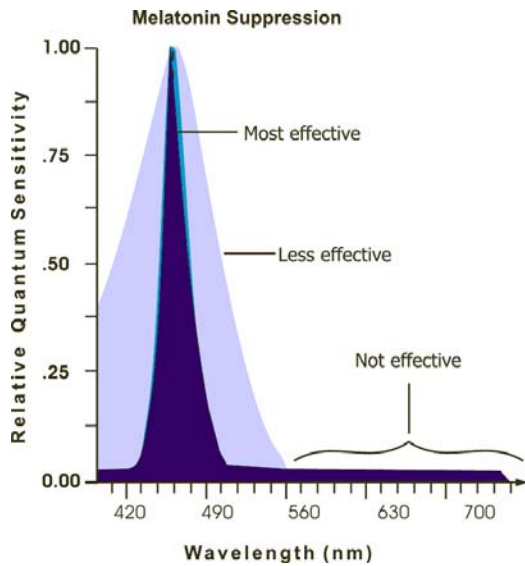


Circadian response is not through the visual spectrum but rather a narrow bandwidth of light from 446-477 nm.

Developing New Technology

The 'melatonin suppression curve' shows which bandwidth of light most effectively suppresses melatonin, and light devices which most closely match this curve will be more effective at treating circadian rhythm disorders. Devices which produce light outside the effective curve are less effective because they increase intensity as well as side effects.¹⁰ In conjunction with TJMU's discovery, Apollo Health, Inc. developed a new lighting technology

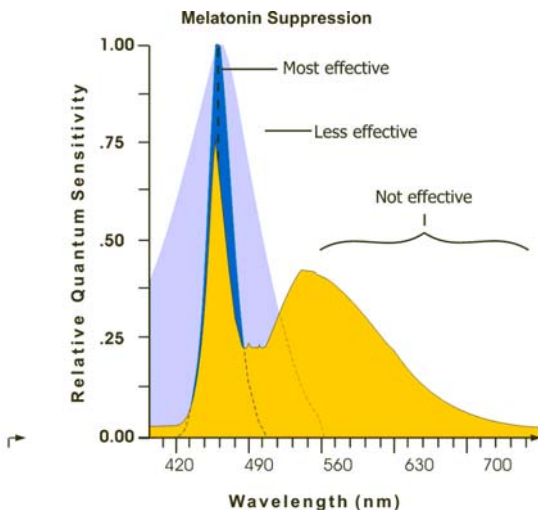
which precisely matches the effective melatonin response curve. This new **BLUEWAVE®** technology was used in TJMU and other research, and is the only method which delivers the action spectrum of light while avoiding unnecessary wavelengths.¹¹



BLUEWAVE® LED technology matches the effective melatonin suppression curve while avoiding non-effective wavelengths

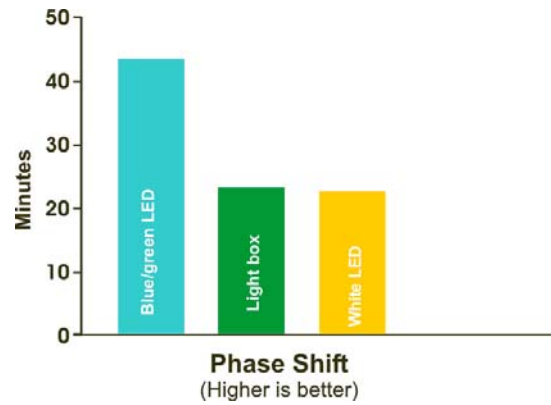
Why Other Wavelengths May Be Counterproductive

Research comparing the action spectrum of light to light boxes and white LEDs showed this bandwidth to be twice as effective at shifting circadian rhythms. Interestingly, the light box produced light in the effective range, and the white LEDs peaked in the effective range (460 nm), but also had a broader peak in the 560 nm range.¹²

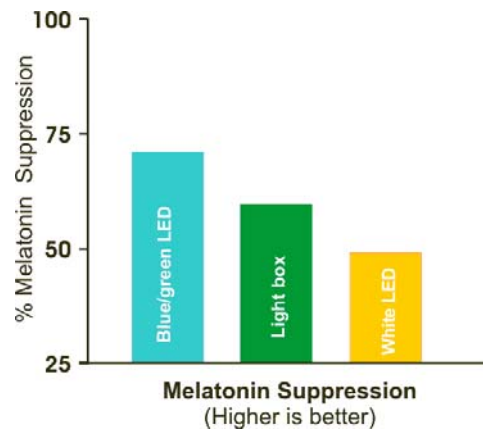


White LEDs produce the most spectral energy in the non-effective range, canceling their effectiveness.

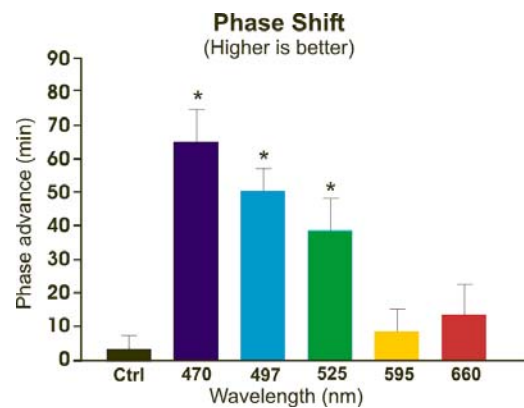
Although the white LEDs also peaked in the effective range, they were half as effective as lights which only peaked in the effective range.



Specific bandwidth LED's are 2 X more effective at shifting circadian rhythms than either white LEDs or standard light boxes.



Specific bandwidth LEDs are significantly more effective at suppressing melatonin than either light boxes or white LEDs.

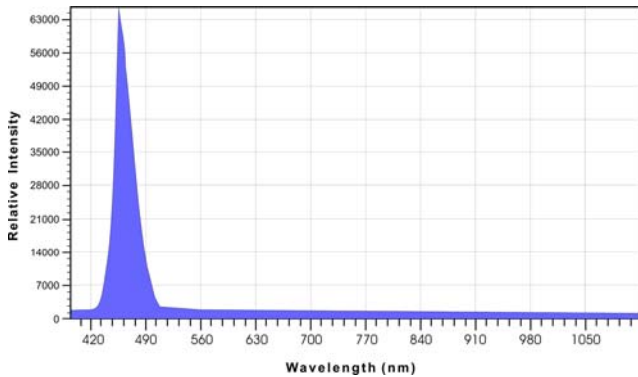


470 nm LED light is most efficient at producing circadian shifts. Light beyond 550 nm did not significantly shift circadian rhythms.

Apollo® BLUEWAVE® Technology™

GoLite Spectral Analysis (BLUEWAVE® LEDs)

04/20/2005, International Light Spectra-radiometer, model RPS900

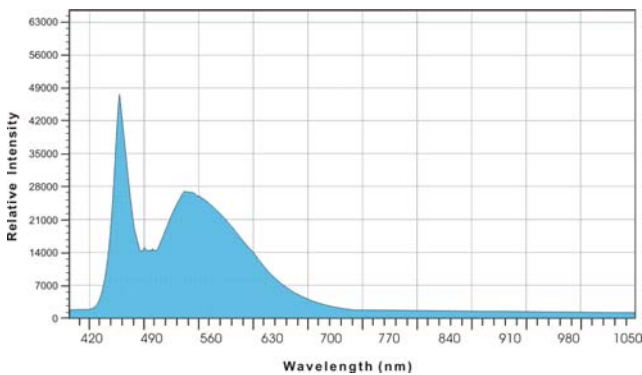


At 24 inches the goLITE® BLUEWAVE® LED technology produces 100% of the effective spectrum of light¹³. BLUEWAVE® peaks at exactly 464 nm and is limited to the most effective melatonin suppression curve. Because BLUEWAVE® only produces this specific band, the GoLITE® maximizes effectiveness while minimizing overall intensity and glare.

White LED Devices

Nichea White LED Spectral Analysis

04/20/2005, International Light Spectra-radiometer, model RPS900



Analysis of white LED devices shows over half their spectral energy is in the non-effective 560 nm + range. Although they peak in the effective range, most of their spectral output is in the broader, ineffective range, and require twice as much time as specific bandwidth LEDs to produce an effective response.

goLITE® Advantage

The spectral output of the goLITE precisely matches the most effective melatonin suppression curve, allowing for the most

efficient melatonin suppression and circadian shifting. Studies using specific bandwidth LEDs achieved twice the circadian shift as white LEDs and standard light boxes. A recent comparison study observed the following:

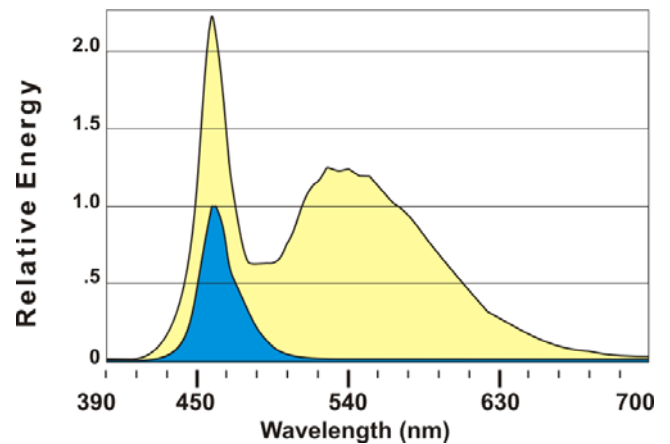
“Perhaps of greater clinical relevance is the question of phase delay induced by these light sources. From only a single light pulse of 2 hr duration, we obtained a phase delay of 22 min with the white LEDs and 42 min with the blue/green LEDs.¹⁴”

Why Don't Other Companies Use Specific Bandwidth Technology?

A quick internet search reveals that several companies make similar claims about incorporating blue light into their products. Some use blue fluorescent bulbs, blue coated bulbs, and others use broad band LEDs while claiming they produce more of the effective blue bandwidth. However, Apollo is the only company to work with these researchers, and Apollo has patent protection on its specific bandwidth technology (BLUEWAVE®). Although other companies claim to benefit from this new technology, it is not available to them.

GoLITE® vs White LED Spectral Analysis

11/04/2005 International Light Spectra-radiometer, model RPS900



The goLITE® produces 100% of the intensity of 470 nm blue light recommended by research¹⁵. Other products exceed the recommended level by approximately 70%. Measured by lux, the increase in intensity is up to 12.5 times that of the goLITE®.

BLUEWAVE® Technology in Research

BLUEWAVE® technology was developed through a National Institutes of Health grant and was proven effective in published research.¹⁶ BLUEWAVE® was also demonstrated at Rush Presbyterian in Chicago, and ongoing clinical tests are being conducted at Brigham and Women's (Harvard) and McLean Medical

School in Rhode Island. Clinical testing and tens of thousands of satisfied customers confirm the effectiveness and increased safety of BLUEWAVE®.

Conclusion

Apollo's patented BLUEWAVE® technology is the only method that delivers the effective intensity of the action spectrum of light. The specific bandwidth was discovered by Thomas Jefferson Medical University, and Apollo owns the patent applications for

BLUEWAVE® technology. BLUEWAVE® was developed by Apollo in conjunction with TJMU. Although a few companies claim to have this or similar technology, they do not. Apollo Health, Inc. is the only light therapy company to have participated in these research studies, and only Apollo is authorized to research and manufacture devices with BLUEWAVE® technology.

References

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- ⁶ Ibid
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- ¹² Wright
- ¹⁴ ibid
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- ¹⁶ Byrne et al