

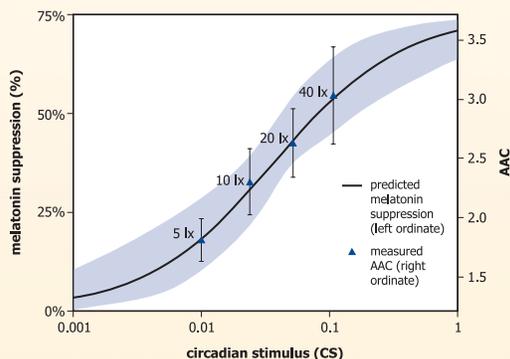
# Light as an Alerting Stimulus for the Circadian System

Exposure to light during the circadian night has been shown to increase alertness. Previous studies showed that blue light, which peaks close to the spectral sensitivity of the circadian system, can have nighttime alerting effects in humans. In this latest study, LRC researchers established a functional relationship between nocturnal blue light exposure and alertness. They then compared this relationship to predictions of nocturnal melatonin suppression made using the circadian phototransduction model developed by LRC research in 2005.

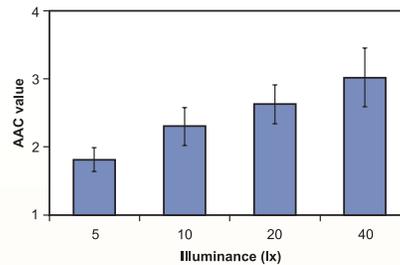
## Method

Eight subjects were exposed to 50-minute durations of blue light ( $\lambda_{\max} = 470$  nm) at the cornea (5, 10, 20 and 40  $\mu\text{W}/\text{cm}^2$ ; 5, 10, 20, and 40 lux) during four nighttime sessions. The subjects were exposed to all four blue light levels in one night in a counterbalanced manner.

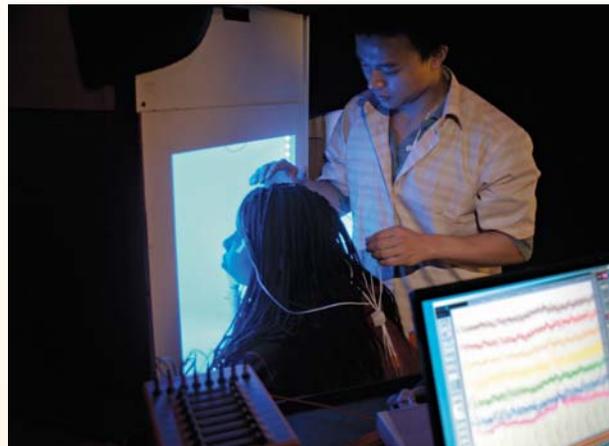
Researchers measured alertness using the ratio of EEG alpha power density with eyes closed to that with eyes open. This ratio is called alpha attenuation coefficient (AAC). An increase in AAC indicates a higher alertness level. They measured subjective ratings using the Norris mood scale.



Predictions of nocturnal melatonin suppression (solid line and shaded area) and measured average AAC values (triangles) for each light level used in the present study.



Mean  $\pm$  s.e.m. (standard error of the mean) AAC values for each light level, calculated from the mean of ratios of the alpha power with eyes closed to eyes open, for each pair of 1-minute measurement epochs.



LRC researcher adjusts EEG electrodes on study subject undergoing blue light exposure.

## Results

The present results demonstrate that there is a monotonic dose response relationship between blue light exposures and alertness, measured both objectively (AAC) and subjectively (Norris Scale). AAC values were also highly correlated with predictions of nocturnal melatonin suppression for each lighting condition, consistent with the inference that the circadian system plays a role in human nocturnal alertness. More importantly, these results strongly suggest that the model of circadian phototransduction developed in 2005 can be used to characterize accurately the photic stimulus for light-induced nocturnal alertness for any light level or spectrum.