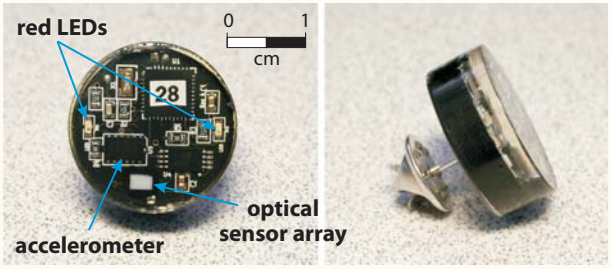
The Dimesimeter: A User-friendly Circadian Light and Activity Sensor

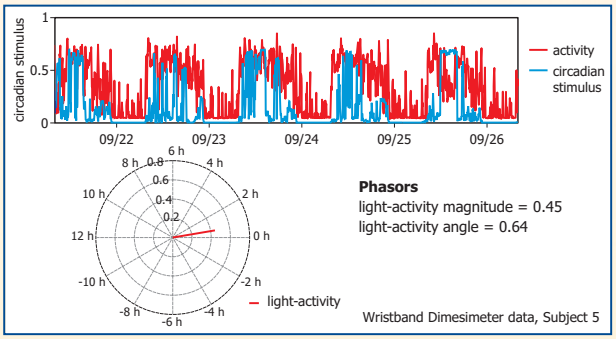
The Dimesimeter was designed to be a small, unobtrusive and inexpensive data logging device, approximately 2 centimeters in diameter — slightly larger than the size of a US $.10 coin — to record light and activity levels continuously over many days. It is a self-contained, epoxy-encapsulated, battery-powered, electronic device that communicates with a docking station via an optical interface to a personal computer (not shown). It can be worn by a subject in a variety of ways. It can be fitted with a pin for attaching to a shirt collar, lapel, or hat. Other versions include a wristband, a pendant, a badge, and a glasses clip.

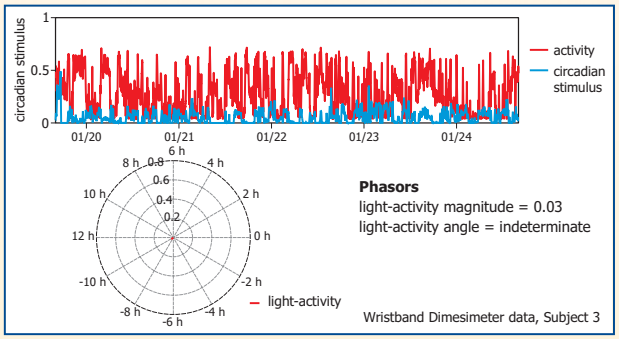


The Dimesimeter is calibrated in terms of the spectral sensitivities of the visual and the circadian systems. Light sensing is performed with an integrated circuit (IC) sensor array that includes optical filters for three measurement channels: red (R), green (G), and blue (B). A monolithic IC accelerometer measures accelerations in each of three planes. It can be deployed for subsequent data download and analysis for continuous usage for up to a month.

The Dimesimeter's small size enables researchers to examine light/dark and activity/rest patterns in groups who show circadian sleep disorders, such as Alzheimer's disease (AD) patients. In fact, AD patients who are receiving a lighting intervention designed to improve their rest/activity patterns and increase their sleep efficiency are currently wearing the Dimesimeter. The device will help to determine their light/dark and activity/rest patterns before and after the lighting intervention, which was designed to maximally affect the circadian system during daytime hours. The Dimesimeter also provides researchers with an objective measure of daily and nightly light exposure levels. Finally, the RGB channels enable researchers to measure the chromaticity of the light sources experienced throughout the deployment period.

Phasor analysis, used to quantify circadian entrainment and disruption, is applied to the recorded light and activity data from the Dimesimeter as well as from a similar measurement device, the Daysimeter, also developed by LRC researchers. The figure on the left, below, shows results from a healthy 67-year-old subject. On the right, the figure shows results from an 81-year-old person with Alzheimer's disease with a short phasor and significant circadian disruption.





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For more information on the Dimesimeter regarding its operation and calibration, please refer to the following file:
http://www.lrc.rpi.edu/programs/lighthealth/pdf/dimesimeterDoc.pdf

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