Soft Lights Foundation

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January 21, 2022

BY EMAIL

Naomi Miller, Senior Lighting Research Scientist
Pacific Northwest National Laboratory
Naomi.Miller@pnnl.gov

Re: The LED Fraud

Dear Naomi Miller,

The purpose of this letter is to formally notify you that any research that you perform that treats an LED light beam as a uniform light source invalidates the results of the research. Any research study that involves LEDs must account for the spatial, spectral, and temporal properties of the specific LED being used for the study. In terms of spatial properties, the study must define the luminance and radiance values at every point in space and be precise to the femtometer scale. An LED is a flat chip source which creates a directed beam of non-uniform energies.

LED electromagnetic radiation devices emit non-uniform radiation that is exceedingly intense in the middle of the chip. While human comfort level is approximately 300 nits of uniform luminance, today's LED chips can have a peak luminance exceeding 100,000,000 nits[1] and an extreme variability between the peak luminance and the edge luminance.

The injuries caused by LEDs is being documented. MarieAnn Cherry is an adult who has epilepsy, a formally recognized disability, and who has been sickened by LED light beams many times. Her exposures to LED light beams, even for a fraction of a second, has led to hundreds of seizures resulting in broken bones, lost teeth, and psychological trauma. MarieAnn has researched the issue and has written up a synopsis of how the safety of LEDs has been ignored by the authorities.[2] MarieAnn's document also contains links to 40 studies on the toxic effects of LEDs.

MarieAnn has compiled a list of verifiable quotes from persons who have been injured by LED exposure.[3] Since it is unethical to directly study whether a technology triggers a life-threatening seizure in humans by exposing the person to the possible trigger and it is also unethical to involuntarily subject

[1] https://www.laserfocusworld.com/test-measurement/research/article/16555223/nonlaser-light-sources-highluminance-leds-target-emerging-automotive-lighting-applications
[2] http://www.softlights.org/wp-content/uploads/2022/01/One-Third-of-us-at-Risk_-The-Medical-science-of-LEDs.pdf
[3] http://www.softlights.org/wp-content/uploads/2022/01/Quotes-from-individuals-harmed-by-LED-exposure.pdf

humans to medical experiments,[4] a study does not necessarily have to be carried out in a laboratory. A study of verifiable reports of incidents related to LED light beam exposure is a valid study.

MarieAnn's efforts highlight the toxic effects of LED light beams on people with epilepsy, but the toxicity of spatially non-uniform electromagnetic visible radiation impacts all members of the public and all other creatures such as owls, insects, and fish because of the way it interferes with the proper functioning of nerves, and the damage to the eye caused by chemical and thermal damage.

To assist you with understanding the nature of LED light beams, we provide the following information.

The left side of Figure 1 shows a spherical emitter that sends light in all directions in space. Because of the curvature of the emitter, the light rays do not overlap, and the radiation is spatially, spectrally, and temporally uniform. Every single point on the sphere is the same as any other point. On the other hand, the right side of Figure 1 shows a flat surface emitter such as an LED, which has a middle and edges. This flat surface creates a situation where the middle of the chip has different energy than the edges of the chip. LEDs send light only in the forward direction and the light rays are confined to an 'escape angle' which is determined by the physical characteristics of the chip. Thus, there are overlapping rays, with the most overlap being in the center of the chip, and the least overlap being on the edges. The result is that every point in space has different spatial, spectral, and temporal properties.

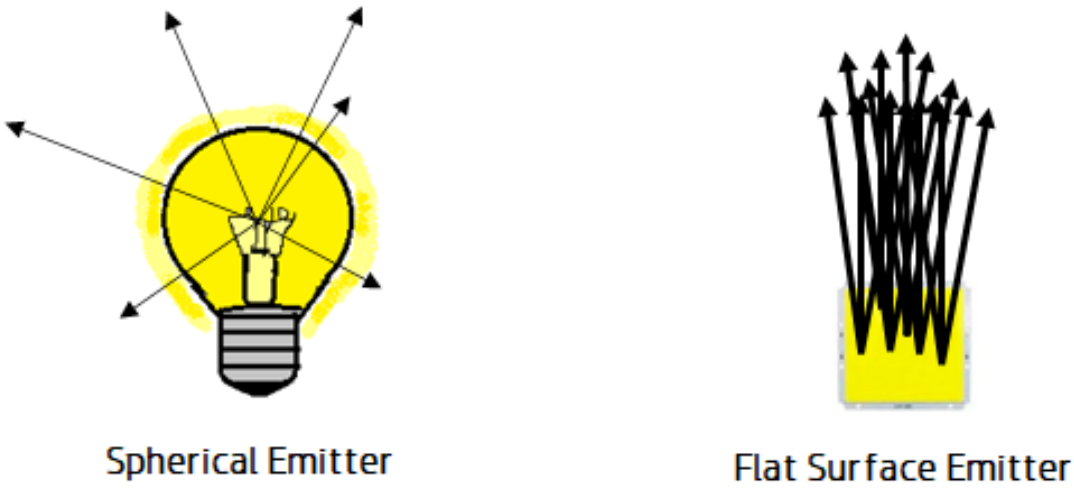


Figure 1 - Spherical vs. Flat Surface Emitter

[4] https://media.tghn.org/medialibrary/2011/04/BMJ_No_7070_Volume_313_The_Nuremberg_Code.pdf

Figure 2 shows the uniform spatial energy from candles, incandescent and High-Pressure Sodium versus the non-uniform spatial energy from an LED. The intense peak of energy will cause eye damage and will overload the nerve signals to the brain because the information is not uniform. These negative outcomes are the effects of the toxicity of LEDs.

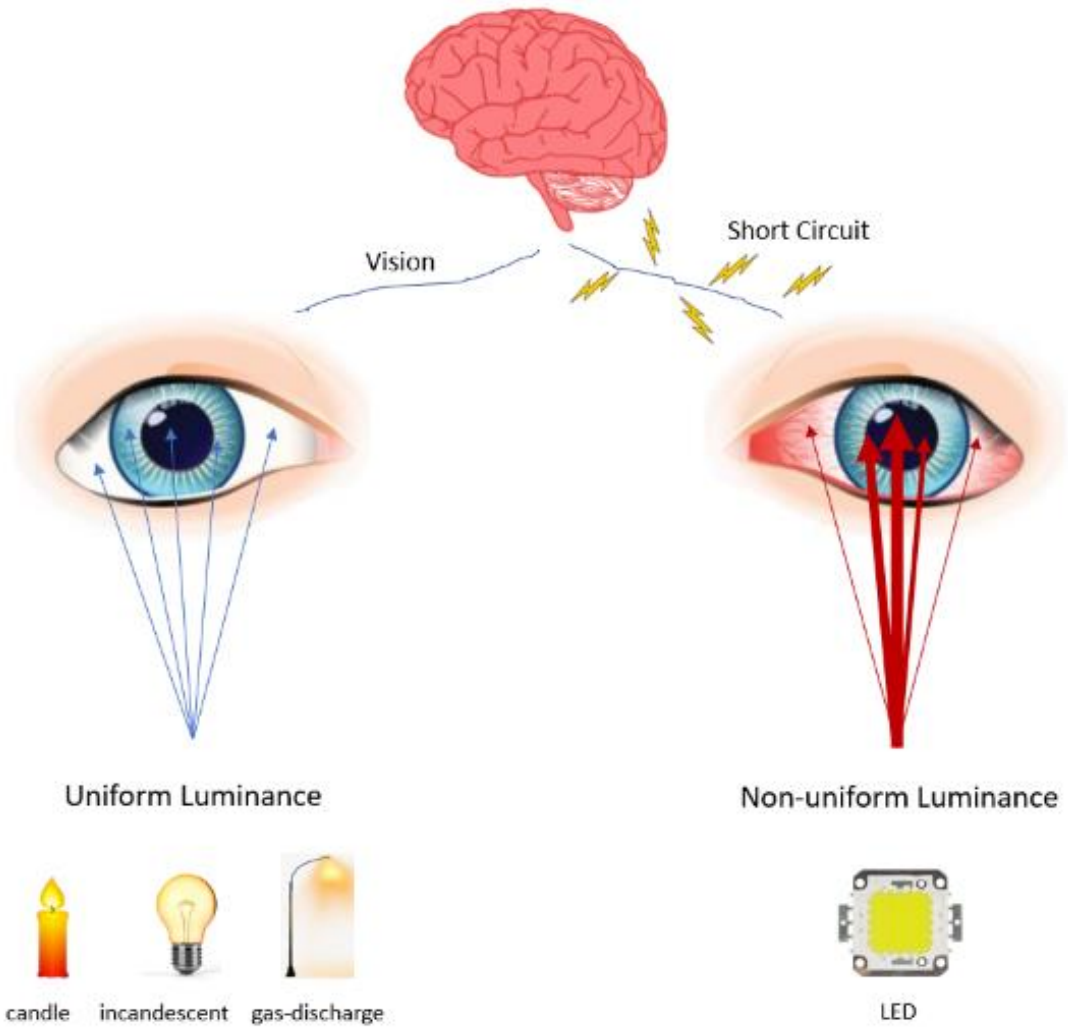


Figure 2 - Spatially Uniform v. Non-Uniform Radiation

Figure 3 is a diagram showing the categorization of radiation and shows that *light* and *illumination* are spatially isotropic radiation in the human visible portion of the electromagnetic spectrum. Electromagnetic radiation emitted by LEDs do meet the regulatory meaning of or comply with standards for the use of light as illumination. For example, the Illuminating Engineering Society IES RP-8-18 for Roadway Lighting is only applicable for uniform emitters and cannot be used for LED light beams.

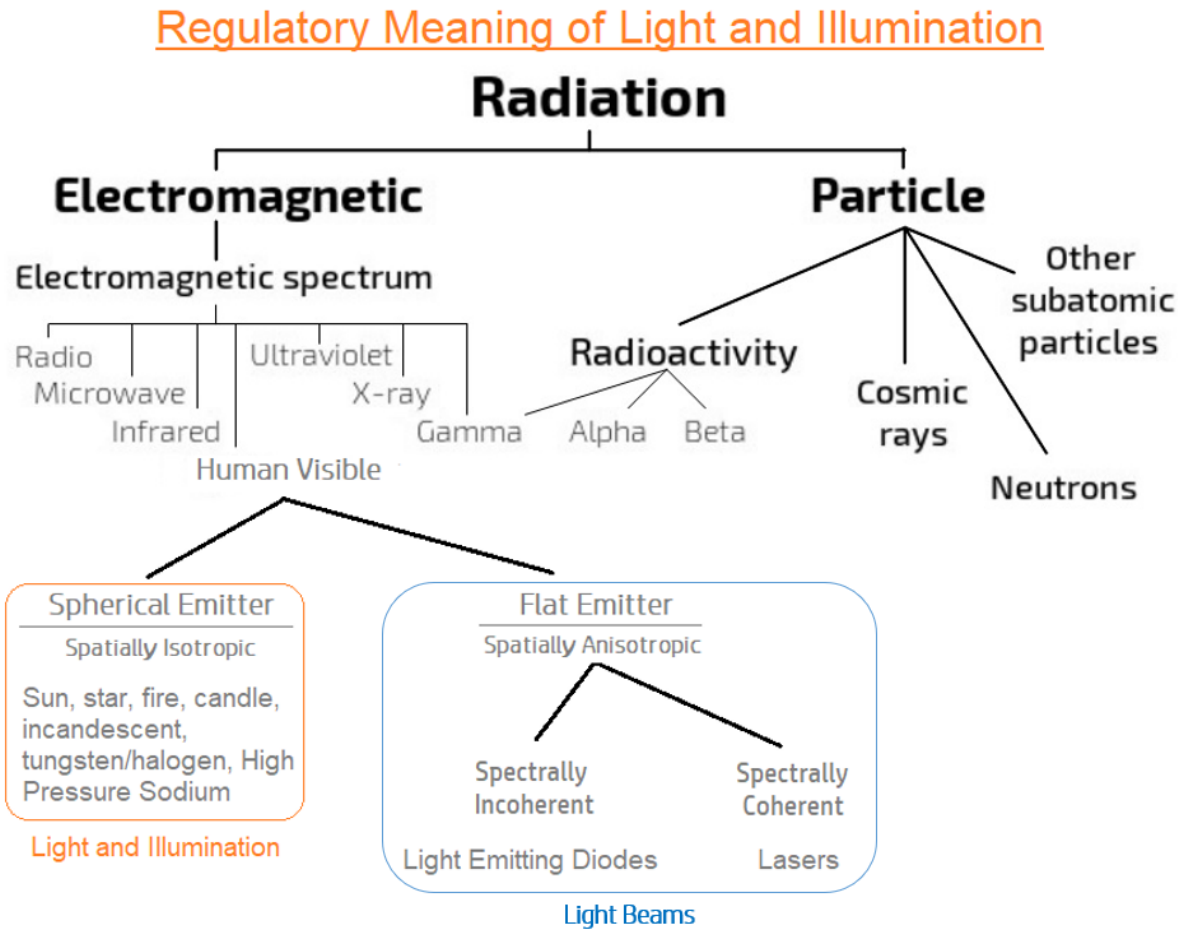


Figure 3 - Radiation Types

As an example of how dangerous LED radiation is, the operator's manual for the Ryobi P705 Flashlight includes the following: "*WARNING: Do not direct the light beam at persons or animals and do not stare into the beam yourself (not even from a distance) Staring into the light beam may result in serious injury or vision loss.*" The warning also refers to children, who along with infants are an identified high-risk population vulnerable to LED-exposure harm. Babies often lack an adult's automatic, self-protective aversion response to bright or intense light, and will stare directly at the source. The parenthetical "(not even from a distance)" indicates a high level of danger and alludes to the physics that LEDs are light beams, not uniform light.

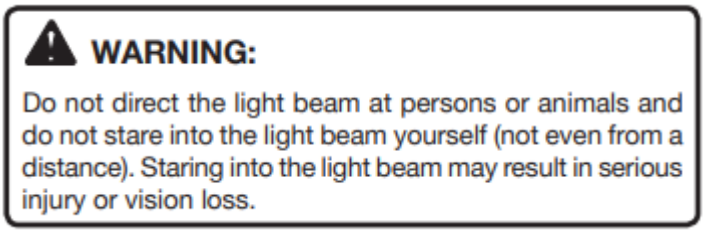


Figure 4 - LED Warning Label

An example of the difference between Tungsten and LED headlights is shown in Figure 5. A tungsten light falls uniformly onto the eye, not counting lensing. LEDs emit an extreme variability in luminance values, such that the difference between luminance values at each angle is different, and the difference between the peak luminance and the edge luminance is extreme.

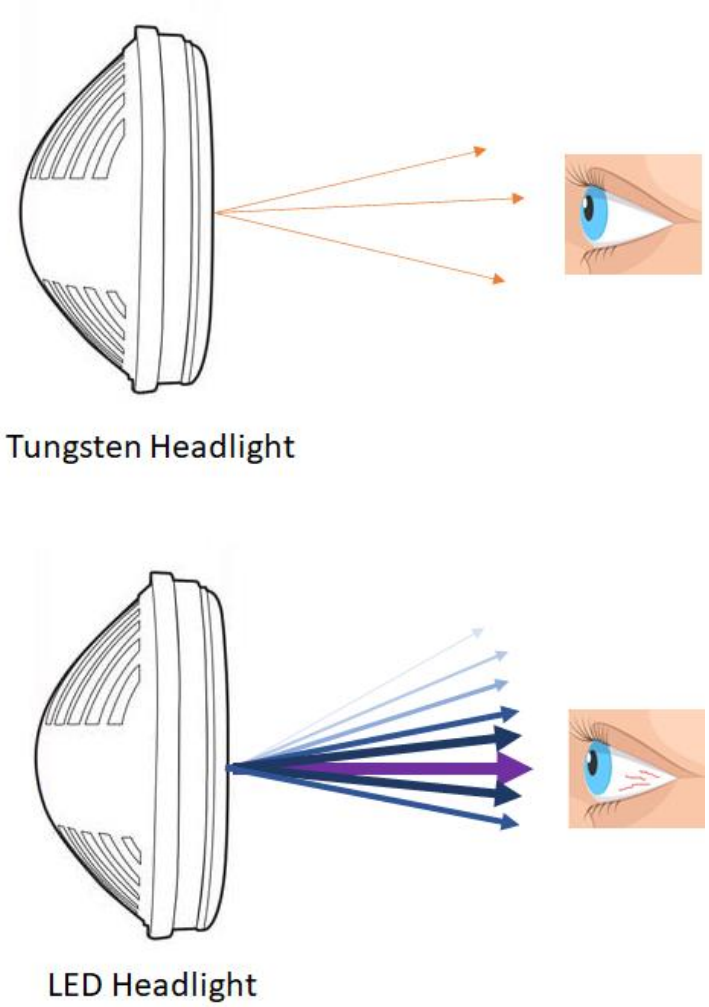


Figure 5 - Headlight Comparison

Figure 6 is a photograph taking in October 2021 showing the impacts of using LED headlights.

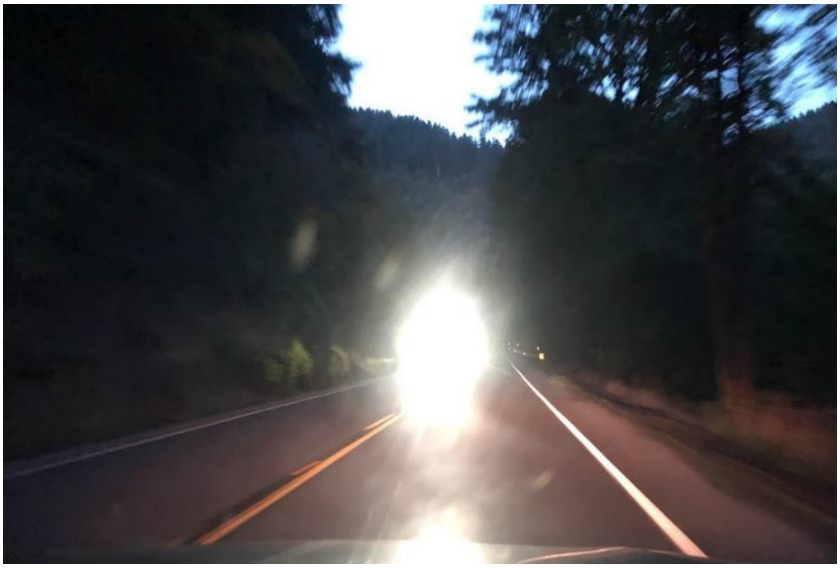


Figure 6 - LED Headlight Glare

The National Highway Transportation Safety Administration has never approved spatially anisotropic visible radiation from a flat surface for use as a vehicle headlight, Daytime Running Light, taillight or flashing light. For aftermarket headlights, NHTSA has released a letter confirming that NHTSA has never approved any aftermarket LED headlights[5] Therefore, all LED use as headlights and Daytime Running Lights on vehicles are illegal.

The link to the video for Figure 7 shows how incandescent hazard lights work. They give a slow, general, soft warning and let people know that the vehicle is in an unusual situation without detracting from the task of driving or walking.

Non-LED Hazard Lights: https://youtu.be/DHJZTb7qXQo

Figure 7 - Non-LED Hazard Lights

[5] http://www.softlights.org/wp-content/uploads/2021/12/Leroy-Angeles.pdf

The links to the videos for Figure 8, Figure 9, and Figure 10 show the misuse of technology, where flashing LED radiation devices do not carefully warn, but rather assault people, violating their civil rights, damaging their eyes, interfering with the functioning of their nerves, and endangering their lives.

Rectangular Rapid Flashing Beacon: https://youtu.be/KBltx0Argag

Figure 8 - RRFB

Utility Truck: https://youtu.be/ma0hGwHivO4

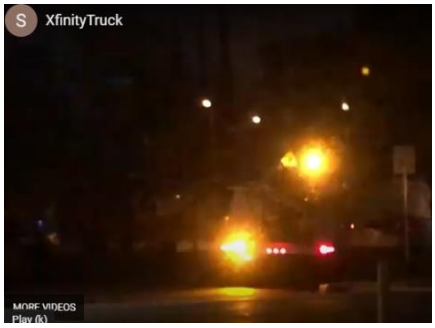


Figure 9 – Utility Truck

Utility Truck: https://youtu.be/0MLDA6too1Q

Figure 10 - Utility Truck

Figure 11 is a diagram showing why the spatial distribution of LED radiation is to toxic and dangerous. The peak luminance of an LED can be hundreds of thousands or even hundreds of millions of nits, far exceeding human thresholds, and the non-uniform shape and extreme variability of luminance interferes with the human nervous system.

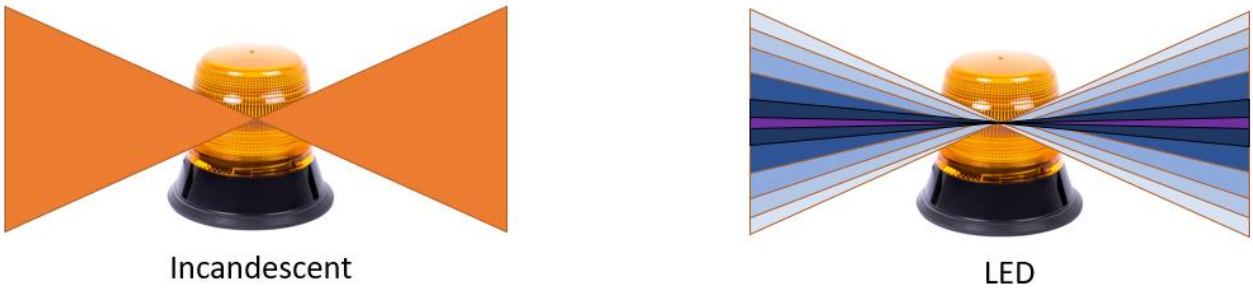


Figure 11 - Incandescent vs. LED Flashing Lights

In addition to the spatial characteristics of LED radiation, the spectral and temporal characteristics also make LED radiation dangerous. LEDs turn on and off almost immediately, giving the brain no time to adapt to change. An LED can also have a peak of 450nm blue wavelength that causes glare and eye damage. The extreme variability between the exceedingly dense peak radiance and the edge radiance triggers seizures, causes migraines, interferes with human nerve functioning, reduces vision, increases agitation, and endangers the lives of the public and first responders.

Neither the FHWA nor NHTSA currently have regulations for the quantity of LED flashing devices, their flash rate, peak radiance, or protection for eyes, vision, or neurology and neither agency has made an effort to ensure that LED flashing lights do not violate the Americans with Disabilities Act. Both human drivers and Artificial Intelligence drivers rely on sensors to receive input from the world about them and a communication channel to send that input to a processing center. LED flashing lights interfere with this system, degrading vision, and increasing the likelihood of vehicle crashes, injury, and death.

Appliances such as dishwashers, microwave ovens, washing machines, and refrigerators now use LEDs which are painful and dangerous. Figure 12 shows how consumers are dealing with the dangerous LED indicator lights by taping over them.

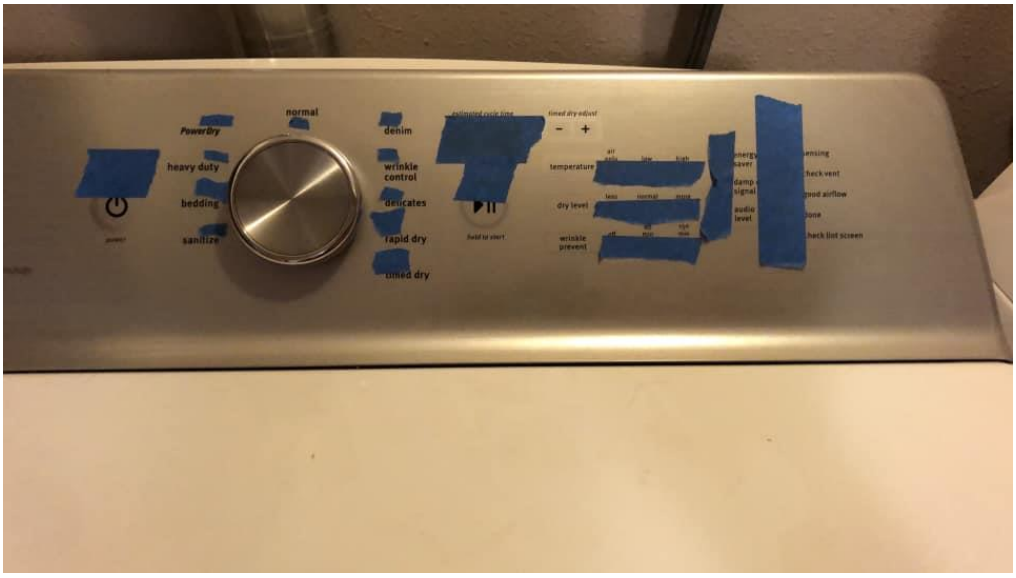


Figure 12 - Washing Machine

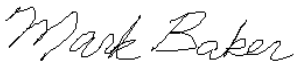
The result of exposure to LED radiation is immediate sickness in the form of headaches, nausea, eye pain, loss of balance, migraines, panic response, altered vision, epileptic seizures, disorientation, and other neurological disturbances. Each of these symptoms is being verifiably reported by an increasing number of individuals and constitute medical evidence of LED-induced harm. LED visible radiation exposure is causing catastrophic physical harm, subjecting at-risk individuals to illness and injury, and plunging formerly healthy, independent people into crisis levels of stress, hopelessness, psychological trauma, and persistent thoughts of suicide.

LED radiation is discriminatory because it interferes with human nerves and disrupts major life functions such as seeing, thinking, and concentrating for people with disabilities, such as those with epilepsy, autism, PTSD, migraines, bipolar disorder, and others. Electromagnetic LED radiation prevents safe access to public services such as roads, sidewalks, and government facilities. Use of LED electromagnetic radiation devices violates the federal Americans with Disabilities Act.

LEDs are a light beam, not uniform light. LEDs are not a point source of light. LEDs do not have a uniform spatial shape. LEDs have an extreme difference between the luminance in the middle of the chip and the edge of the chip. LED luminance and radiance measurements must be taken in a laboratory with equipment and software that is precise to the femtometer scale. Any use of field measurements outside of the lab will be inaccurate and unusable. Research papers must include the luminance, radiance, and absolute spectral power distribution for every point in space at the femtometer scale. All temporal measurements must include chip-level flutter, circuitry level flicker to at least 10,000 Hertz, and ramp-up and decay values.

As we understand it, your research on LEDs until now has now has not met these requirements and are likely invalid. Any future research that continues to ignore these parameters would likely be considered negligent or fraudulent and could make you liable for harms caused by your research on LEDs.

Sincerely,



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