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For any questions or comments please contact us at

pr@studioroosegaarde.net

FAQ Urban Sun

What is Urban Sun?

Urban Sun is a floating design installation. By emitting specific light at precisely 222nm, air and surfaces within the light circle are cleaned of viruses, including coronavirus. Urban Sun aims to visualise hope and to make community events safer by applying this specific far-UVC light.

Inspiration

Addition

Urban Sun is a living lab by Studio Roosegaarde, for universities, engineers, designers, and technology partners. By applying creative perspectives and scientific methodology, Urban Sun is designed to create a space for us to renew our connection to one another. The wavelength of ultraviolet 222nm can be used as a tool to limit the chances of spreading harmful viruses. The goal is to bring back public well-being and safety by reducing the presence of aerosol coronavirus in public spaces. Cooperation and research are vital for success, which is why Studio Roosegaarde has paired with researchers and scientists from universities worldwide. The technology has also been measured and calibrated by the Dutch National Meteorology Institute. Urban Sun works on new technological solutions by pairing design with science while acknowledging the emotions involved in the struggle to preserve public spaces and events for social interactions. It is meant to be a practical starting point for future research.

What is the inspiration of the Urban Sun?

The powerful light of the sun supports all life on Earth. We dreamt about an Urban Sun, floating above our cities and could help to enhance our well-being. Our world suddenly became filled with plastic barriers, warning stickers and social distancing. Daan asked himself how we could clean our cities of the coronavirus. He wondered if light could help to restore safer encounters in public spaces, and if we could be not scared, but curious about our future and the ways to live within our new normal. He remembered reading about a wavelength of far-UVC light at 222nm that can kill viruses, while remaining safe for humans and animals. So began Urban Sun.

Where did the idea behind the technology of Urban Sun come from?

The following is a shortlist of the research articles which served as the scientific inspiration for Urban Sun.

Source 1: Nature article "Far-UVC light: A new tool to control the spread of airborne-mediated microbial diseases" <https://www.nature.com/articles/s41598-018-21058-w>

Source 2: “Far-UVC light (222nm) efficiently and safely inactivates airborne human coronaviruses” <https://www.nature.com/articles/s41598-020-67211-2>

Source 3: ‘Study shows first proof that a safer UV light effectively kills virus causing COVID-19’ <https://www.hiroshima-u.ac.jp/en/news/60119>

Source 4: “Far UVC light safely kills airborne coronaviruses”
<https://www.cuimc.columbia.edu/news/far-uv-c-light-safely-kills-airborne-coronaviruses>

Who is behind the Urban Sun?

As a social design lab, Studio Roosegaarde creates projects which connect people and technology to improve daily life in urban environments, spark imagination and fight social and environmental issues like the global climate crisis. Daan Roosegaarde and his team of designers, engineers, project managers, technical experts, scientists and government departments worked together on the world's first Urban Sun.

Previous projects include SMOG FREE PROJECT (the world's first and largest outdoor air purifier which turns smog into jewellery), SMART HIGHWAY (roads that charge throughout the day and glow at night), the SPACE WASTE LAB (visualising and upcycling space waste) and the most recent project, GROW, which highlights the beauty of agriculture.

Daan Roosegaarde's mantra 'Schoonheid', is a Dutch word meaning both beauty and cleanliness, as in clean space, clean air, clean water, clean energy. The word 'schoonheid' is an activator for change, for citizens, makers, NGOs, and governments to value and empower 'schoonheid' as a creative force to make clean environments.

More info at <https://www.studioroosegaarde.net/info>

What do I see?

When the sun goes down an urban phenomenon, characterized by a glow of light in the evening sky, appears. Urban Sun aims to enhance our well-being by shining its helping light in public spaces. The project visualizes hope. There is a warm yellow beam of light and within this black circle of this light the air is being cleaned. Urban Sun demonstrates how design can meet science and how we can create a better future.

Safety & Science

Is Urban Sun safe?

The Urban Sun design is based on independent research from scientists in the US and Japan, who proved the use of far-UVC can effectively eliminate up to 99.9% of viruses in the air without harming people and animals. Research shows that though traditional 254nm UV light is harmful, the new far-UVC light with a wavelength of 222 nanometers can safely reduce viruses. The technology was originally used in hospitals to reduce the risk of infections during operations. Several experts have validated the safety and effectiveness of Urban Sun.

Has Urban Sun been tested?

Urban Sun has been modeled by [MEG Science](#), a consulting firm operating in Applied Photobiology based in Milan, Italy. The measurement and calibration of the actual far-UVC wavelength of Urban Sun was conducted by the VSL Dutch National Metrology Institute in Delft. Urban Sun also meets the International Commission on Non-Ionizing Radiation Protection (ICNIRP) safety guidelines for ultraviolet light.

After the public launch, a recent interview on Dutch Public Radio NPO1 (<https://twitter.com/NPORadio1/status/1367144183908229133>) renowned independent virus experts Ab Osterhaus, Andreas Voss, and Ivo Lede, who were not involved in Urban Sun, expressed the value and effect of Urban Sun. More exhibitions and its results will be shared in the nearby future.

What is the Urban Sun technology?

Urban Sun uses a custom made far-UVC 222nm light source which can reduce aerosol viruses. Unlike other far-UVC light sources, Urban Sun has been engineered not to produce ozone and does not contain mercury. It aims to disinfect the surfaces and air of all bacteria, viruses and spores in seconds and minutes.

Does Urban Sun also work with "the mutations"?

Far-UVC 222nm works for all viruses including influenza and variations.

How is Urban Sun different from similar technologies?

Urban Sun is the world's first outdoor far-UVC 222nm. The team behind Urban Sun works extensively with a broad spectrum of companies and researchers currently developing far-UVC technologies. Collaborations and multiple solutions are crucial as we design our new normal.

I read on the World Health Organization's website that UV should NOT be used to treat coronavirus - why are you saying it does?

Traditional ultraviolet light machines like the ones mentioned on the [WHO's website](#) emit ultraviolet light at 254 nanometers. This wavelength can indeed be harmful to human skin. Research shows that though traditional 254nm UV light is harmful, the new far-UVC light with a wavelength of 222 nanometers can safely reduce viruses.

Urban Sun emits far-UVC at 222 nanometers, which has been shown to destroy airborne viruses, without being harmful to human skin. Urban Sun is not intended to treat people who have tested positive for the coronavirus. It is intended to create spaces in which aerosol transmission of the coronavirus is reduced.

Ultraviolet light should absolutely not be used to treat anyone who has tested positive for covid-19, nor anyone who has come in contact with someone who has. Research shows that though traditional 254nm UV light is harmful, the new far-UVC light with a wavelength of 222 nanometers can safely reduce viruses.

Short Answer: Urban Sun emits far-UVC at 222 nanometers, which has been shown to destroy airborne viruses, without being harmful to human skin. This is different from the traditional UV light that the WHO's recommendation refers to. For more information, visit the Studio's website

But UV is dangerous, right?

Research shows that though traditional 254nm UV light is harmful, the new far-UVC light with a wavelength of 222 nanometers can safely reduce viruses.

Applications of UV light have existed for more than 80 years. Traditional UV light can have long-lasting damaging effects on people. Newer UV, also referred to as far-UVC light at 222 nm wavelengths is not considered harmful to people. It cannot penetrate the skin or the eyes, as published in the scientific journal Nature and other scientific journals. To make a comparison, old disinfecting lamps with standard, harmful UV emissions had a light wavelength of 254nm. These lamps are not safe for long exposure. The difference in wavelength is what makes the far-UVC harmful for viruses and bacteria, while remaining safe for people and animals.

Is 222nm a shorter wavelength than 254nm?

Yes, 222nm is a shorter wavelength than 254nm. 222nm als 254nm are both in the shortwave range of UV-C.

Why are people in the video hugging?

Prior to the movie shoot, all actors and crew were tested for COVID19, in compliance with Dutch government regulations for media productions. An onsite COVID19 manager was also present. During recording, actors removed masks, but otherwise wore them throughout. Urban Sun is intended to create hope, and the image of possibility. It is not meant to contradict current government regulations. Urban Sun is an additional layer of protection to current government rules and we aim to provide cleaner spaces for safer social gatherings.

Is Urban Sun hazardous for animals such as bees?

222nm light does not induce typical UV-associated skin and eye damage of 254nm UV, as can be read in the referred 2018 Brenner study on UV exposure of animal skin cells. Due to the similarities between human and animal cells there is no reason to suggest this would be hazardous to animals. In terms of behaviour, even though bees are able to see part of the UV spectrum (300nm to 600nm) next to the human visible spectrum (400nm to 800nm) the 222nm light would be just as invisible to them as it is to us.

Does it make dogs go blind?

Scientific research shows that 222nm far-UVC is not harmful to animals and humans. The project follows both the ICNIRP and American Conference of Governmental Industrial Hygienists guidelines for the use of ultraviolet light.

How efficient is Urban Sun?

Urban Sun 222nm light works with the speed of light which is 300.000km/sec.

The technical simulation of Urban Sun shows that a large reduction of viruses can be achieved in minutes.

Efficiency also relates to the international standard of ICNIRP which currently allows 23mj/sec in 8 hours. Urban Sun focusses now on safety standards first, then efficiency.

How old is the 222nm light of Urban Sun?

4.6 billion years, as it is in the light of the sun. The earth atmosphere filters it away. More recently, 2018 was when the first scientific paper regarding potential uses for far-UVC was published in Nature.

I see 222nm lights can be ordered online, is this the same?

Urban Sun is pioneering with light to improve outdoor public spaces. This has never been done before. Smaller and much less powerful indoor 222nm lamps may indeed be made available later by other companies.

Why can't I see the UV light?

UV light is invisible. A visible ring of light encircles the far-UVC light to visually separate the treated space.

Where is the proof that Urban Sun works?

- 1-The project is inspired by and based on the work of scientists in the USA and Japan. Their peer-reviewed article in scientific journal Nature demonstrated the efficacy of the use far-UVC to eliminate 99.9% of viruses in the air without harming people or animals.
- 2- MEG Science, a technical expert in lighting systems and photobiology ran a technical simulation validating the effectiveness of Urban Sun.
- 3- Urban Sun in Rotterdam is measured, and calibrated by the VSL Dutch National Metrology Institute in Delft.
- 4- Urban Sun project follows the International Commission on Non-Ionizing Radiation Protection (ICNIRP) safety guidelines for ultraviolet light.
- 5- A team of external experts and scientists have made supporting statements about Urban Sun.

After the public launch, a recent interview on Dutch Public Radio NPO1 (<https://twitter.com/NPORadio1/status/1367144183908229133>) renowned virus experts Ab Osterhaus, Andreas Voss, and Ivo Lede, who were not involved in Urban Sun, expressed the value and effect of Urban Sun.

Can Urban Sun cure me of the coronavirus?

Urban Sun cannot cure people of the coronavirus. It does aim to provide cleaner and safer public spaces by significantly reducing the presence of coronavirus from the air. Anyone who has tested positive for covid-19 should avoid public spaces as required by their local governing bodies.

What is the light of Urban Sun made of?

The Urban Sun is both a visible light source and a far-UVC source, made from light available in nature. The clean area created by Urban Sun is within a circle of visible light that marks the edges. The design includes the specialised light wavelength of 222nm. The project follows the ICNIRP safety guidelines for the use of ultraviolet light.

There seems to be uncertainty as to whether far-UVC is safe for humans. Is this technology approved for this kind of use public by any regulatory authority?

The measurement and calibration of the actual far-UVC wavelength of Urban Sun was conducted by the VSL Dutch National Metrology Institute in Delft. Based on that it can be stated Urban Sun meets the International Commission on Non-Ionizing Radiation Protection (ICNIRP) safety guidelines for ultraviolet light. Our group of scientists and experts have supported this statement. Urban Sun is supported by the Council of the Public Health & Society Board, the Netherlands' independent parliamentary advising body.

Urban Sun is based on several peer-reviewed scientific studies by Columbia University and Hiroshima University. Many companies are exploring uses of far-UVC light in treating aerosol-borne viruses. Urban Sun is intended to serve as a call to action to all societal actors, including governments, to explore the potential of this technology and design.

Where does far-UVC sit on the UV spectrum?

Far-UVC sits on the far left of the spectrum, visible light in the middle, and infrared all the way to the right.

Your press text says that far-UVC is "new"- what do you mean by this? Surely far-UVC has always existed?

New as in compared to traditional UV, which has been in use for more than 80 years. The industry therefore describes 222nm as 'new', since the science community became more involved in evaluating its use and efficacy starting in 2018.

Your press text says that far-UVC can "safely clean up to 99.9% of the coronavirus" - are you claiming that Urban Sun can do the same? Does this refer to the entire light cone beneath the source?

Urban Sun explores potential. Far-UVC can safely clean up to 99.9% of viruses from the air, including the coronavirus. Given optimal circumstances, Urban Sun may do so. Further research is needed, and Urban Sun should be explored as a potential tool for providing an additional layer of safety.

The intensity of UVC radiation diminishes over distance from the source. What percentage of Covid-19 does it neutralise at ground level? How long would it take to achieve this?

Urban Sun design is focused on the layer around the human body and face height to have the optimal amount of far-UVC light to reduce viruses. This includes factoring in the diminishing of light through distance.

Is Urban Sun hazardous for animals such as bees?

222nm light does not induce typical UV-associated skin and eye damage of 254nm UV, as can be read in the referred 2018 Brenner study on UV exposure of animal skin cells. Due to the similarities between human and animal cells there is no reason to suggest this would be hazardous to animals. In terms of behaviour, even though bees are able to see part of the UV spectrum (300nm to 600nm) next to the human visible spectrum (400nm to 800nm) the 222nm light would be just as invisible to them as it is to us.

Does Urban Sun also kill good bacteria in the human body?

Far-UVC light is efficient at safely killing viruses in the air, but when applied in the right circumstances will not damage microorganisms inside the human microbiome.

Is the amount of radiation measured?

Yes. Urban Sun in Rotterdam is measured and calibrated by the VSL Dutch National Metrology Institute in Delft. The project follows ICNIRP and American Conference of Governmental Industrial Hygienists guidelines for ultraviolet light. The UV light emitted is considered not harmful to humans.

Does the Urban Sun also work for other viruses?

Scientists agree it works on all viruses, including the current coronavirus but also for example influenza. 222nm far-UVC has been tested on coronavirus strings HCoV-229E and HCoV-OC43, and the current coronavirus SARS-CoV 2.

Do government rules regarding coronavirus still apply under the Urban Sun?

Studio Roosegaarde believes it very important to keep following the regulations of the government. So yes, local and national government rules will always apply. Urban Sun is not a replacement for vaccines or other government regulations.

Dutch: Wij vinden het erg belangrijk dat de bestaande overheidsmaatregelen worden nageleefd. Urban Sun is het eerste design wat far-UVC 22 nm toepast in de buitenlucht. Het is zeker geen vervanging van de huidige maatregelen, maar probeert een schonere en veiligere ruimte te stimuleren.

Applications

Are there already potential Urban Sun clients?

Yes, we have interest from cities such as Amsterdam and Milan, but also large-scale events such as Expo Dubai and the Olympics. We would also love to show it at schoolyards and cultural festivals.

All the renderings show the product in use at night. During the day, presumably, the yellow light would be invisible. How will people know where the safe area is?

For now Urban Sun is focussed on evening gatherings, right after sunset, for this very reason. Urban Sun is shown at night in order to ensure the space within is visible. Far-UVC light is invisible to the human eye; the ring of light is a visual cue, not an indicator of efficacy.

Many of the logistical issues surrounding the implementation of Urban Sun are ones that would need to be discussed based on the site specifications. Urban Sun has, and will continue to, evolve as minds from the scientific, design, cultural, and governmental communities are involved in its development.

Why do it outdoors?

The vision is to enhance well-being in public spaces, so people might be able to meet more safely again. There is some research which says outside is safer. Yet we learn every week more about the coronavirus. For Urban Sun any type of improvement of safety in public space is very meaningful right now.

Where will Urban Sun be applied?

Ultimately we hope that Urban Sun will be presented in different public spaces where communities meet. Possibilities include public schools yards, train stations, hospitals, museums, as well as cultural festivals such as Lowlands and the Olympics.

How big a space can Urban Sun shine upon?

The design is scalable. While the technical simulation shows a public square of 100m² and 3500m², a larger space could be covered.

Why isn't it everywhere?

Studio Roosegaarde has invested its own time and funds over the last 14 months into the realisation of Urban Sun. It is intended to serve as a call to action to governments and partners to speed-up further application of Urban Sun, exploring the boundaries of the impact of new innovations. We are open for new collaborations and to research our opportunities. We hope Urban Sun may create safer spaces worldwide.

Is this just a symbol, or a real solution?

Both. Urban Sun is an inspiration to design our new normal, it stimulates development in light science research. Urban Sun is a local solution which uses far-UVC light to create better spaces for human gatherings. The project is about design meeting science. Urban Sun is a starting point for further creative and inspiring solutions.

How much does Urban Sun cost?

Studio Roosegaarde financed the first 14 months of research and design of Urban Sun. For specific requests regarding exhibition of Urban Sun, or to develop a larger Urban Sun, please email urbansun@studioroosegaarde.net with more information such as timeline, location, and production budget to receive more details.

When will Urban Sun be ready?

The first pilot is ready for exhibitions worldwide. Currently the team of designers, project managers, and technical experts are working on more of Urban Sun. We are open to additional opportunities for collaboration with scientists, tech companies and investors to develop the project further.

Where is Urban Sun now?

Urban Sun is in the Netherlands. It is ready for exhibitions and can travel to new locations worldwide.

Most Covid-19 transmission takes place indoors. Transmission outdoors appears to be extremely rare. Why is this product designed for outdoors rather than indoors?

Urban Sun is designed to make human gatherings safer. It was situated outside for the initial launch to create a sense of place, and a vision of possible other locations. Urban Sun can also be applied indoors, but additional modelling would need to take place. Even though outdoor is said to be safer (even science does not state this as a fact) currently all large scale events are prohibited. Urban Sun is intended to create an additional layer of safety, on top of current government regulations. Any improvement that makes a space safer in these times is a positive one.

What is the light fixture of Urban Sun?

The Urban Sun must be suspended in the air and this can happen in various ways.

Does the 'Urban Sun' system have two lamps or light emitters: one that projects far ultraviolet light (invisible) and the other that projects a warm yellow beam (visible)?

Urban Sun shines a large circle of 222 nm far-UVC light into public spaces, cleaning those spaces of the coronavirus. It acts as an additional layer of protection to current government rules. The far-UVC light is invisible. The visible ring of a warm yellow beam of light encircles the far-UVC light to visually separate the treated space.

UV is only effective for cleaning surfaces for very short distances, nothing like the kind of beams I see in Urban Sun. And devices being sold for sterilizing rooms warn you never to look at the light source. And isn't the particle spread outdoors so low as to be insignificant?

Different UV wavelengths have different efficacy and danger levels. Urban Sun's wavelength of 222nm is specially calibrated for this reason; the wavelength is considered safe for humans. Urban Sun is intended to be an additional layer of safety, originally exhibited outdoors but with the hope of future indoor applications. The research behind Urban Sun is available on our website at <https://www.studioroosegaarde.net/stories/urban-sun>.

Outdoors, the air circulates far more freely than indoors. The air in the cone beneath Urban Sun would be constantly changing. How can you ever be sure that you can sanitise the air in the cone to any kind of safe degree?

Again here, it is a 'safer degree', we never say 'safe degree' since conditions can change. By neutralizing aerosol-borne viruses, there are fewer opportunities for them to spread. Shifting air will result in ongoing sanitizing of viruses within the cone. Each Urban Sun will therefore have a site-specific design, which includes elements such as wind and flow of people. Fine-tuning this design creates an optimum impact.

If it takes two minutes (or longer) to neutralise viruses within the air cone, how can it prevent infection? If two people are standing close together, surely virions could pass from one to the other within that time before being destroyed?

We are not claiming that Urban Sun prevents infection. Urban Sun creates a space for safer human gatherings. Government regulations and advisories regarding distancing still need to occur within Urban Sun. Urban Sun reduces risk, it does not eliminate it.

How quickly can Urban Sun clean viruses from the air?

Reduction of the viral load by the far-UVC light is not a linear progression. Initial reduction is very high, and then the rate of reduction increases at a decreasing rate as it approaches 100%. The size of Urban Sun as well as the space within which it is placed dictates the specifications. Original modelling took place in a courtyard in London which was blocked from the wind, increasing the efficacy of Urban Sun. Ultimately, the launch occurred next to a windy river in Rotterdam; the rate of efficiency will depend upon site-specific situations.

What about blind spots? If someone is standing in the shadow of another person, presumably they won't be protected (far-UVC has poor reflection)?

Additional modeling will be necessary, and blind spots are a possibility. Urban Sun is not intended to create a guaranteed safe space, it is intended to create a *safer* space. Precautions regarding the coronavirus include masks, distancing, frequent temperature checks and testing. None of these are a failsafe, but combined have the power to reduce risk. Urban Sun is an additional layer of safety, to be added, not to replace.

How high above the ground does Urban Sun have to be? The renderings appear to show it around 10m above ground level.

The necessary height of Urban Sun depends on many factors, including intended coverage area, wind, capacity, and structures within or surrounding the space. Installations of Urban Sun will need to be evaluated based on these and other factors.

How much would it cost to install each Urban Sun?

The cost of Urban Sun will be determined by many factors, including location, desired coverage scope, and site-specific requirements. For detailed proposals, we request that interested parties email urbansun@studio Roosegaarde.net.

What area (in sq m) could each Urban Sun keep clean of viruses?

This will depend on the height and size of the Urban Sun, and site-specific details. To reiterate, Urban Sun will provide an additional layer of protection, it is not intended to be the sole source of protection, nor should it be applied in contravention to current government regulations. The Urban Sun in Rotterdam is around 100m², the larger design is 3500m² and we are working on much smaller and bigger versions. As a toothbrush prevents cavities, but does not eliminate them, this is dependent upon the circumstances of your tooth care (products, frequency, etc). The same applies to Urban Sun; it is site-specific and optimal results depend on situational detail. Modelling for each exhibition will be made public, as per our commitment to transparency.

Do you think the release of this product is helpful to the debate around Covid-19 transmission and to public understanding of this complex topic?

We believe that people are suffering greatly as a result of social isolation. Many measures have been introduced to allow for our basic needs to be met; masks must be worn in shared spaces, in the Netherlands all restaurants and bars are closed (except for takeout) and there is a curfew in place from 21:00. We believe that pursuing an idea that creates an additional layer of safety creates opportunities for safer human gatherings, an emotional and social necessity that was abruptly cut off a year ago. Discussions about the repercussions of this complex topic are ongoing all over the world; how does social isolation impact the old, the young, the poor, the middle class? Urban Sun is an opportunity for us to discuss what possible solutions might look like, now and in the future.

Do you stand by the claim that Urban Sun "cleans public spaces of the coronavirus"?

Yes. As we have emphasized, Urban Sun is not intended to be an ultimate solution. It is a starting point, a first step towards a better normal. A car has both brakes and seat belts, why should precautions and measures related to viral transmissions be limited to a single solution?

Is the yellow light shown in the renderings just regular light? Is this to give a sense of the (invisible) far-UVC light?

Yes. The visible ring demarcates the edge of Urban Sun. Far-UVC is invisible to the human eye, so we created a means by which the space could be visualized.

Press Information

Where can I download press high-res images and movies?

These are freely available when used with credit 'Studio Roosegaarde' at <https://pressroom.studioroosegaarde.net/>

Is Daan Roosegaarde available for interviews?

Please email Studio Roosegaarde with the details of your request at pr@studioroosegaarde.net

Can I get a statement from the designer?

Daan Roosegaarde:

"It is extreme to see how something as small as a virus can have such a huge impact on our lives. Have you seen our public spaces? Fragmented with distance stickers, warning signs and plastic barricades, where people are afraid to meet and shake each other's hands."

"We cannot go back to our old lives. We have to use our fear, frustration, and despair as inspiration for change. We have to zoom out, and start to design this new normal together."

"That is what inspired the Urban Sun with its specific light. For me this design is an activator to inspire a better new normal. We want to do more, not less."

“The power of light can help. Not as a solution to all our problems, but as a first proposal to design our way out of it. To create new, and safer places where we can meet each other. If we are not the creators of our future, we are its victims.”

Relevant links:

*Source: "Far-UVC light (222nm) efficiently and safely inactivates airborne human coronaviruses" <https://www.nature.com/articles/s41598-020-67211-2> and <https://www.hiroshima-u.ac.jp/en/news/60119>

1_Far-UVC light (222nm) efficiently and safely inactivates airborne human coronaviruses <https://www.nature.com/articles/s41598-020-67211-2> Columbia University New York

2_Long-term Effects of 222nm ultraviolet radiation C Sterilizing Lamps on Mice Susceptible to Ultraviolet Radiation

<https://onlinelibrary.wiley.com/doi/full/10.1111/php.13269> Hiroshima University

<https://www.hiroshima-u.ac.jp/en/news/60119>

3_Technical information of far-uvc supplier: <https://healtheinc.com/learn/far-uv-c-222/>

4_International UV safety standards: ICNIRP

<https://www.icnirp.org/en/about-icnirp/aim-status-history/index.html>. And American Conference of Governmental Industrial Hygienists (ACGIH®).

5_eerste restaurant in USA met far-uv-c: <https://www.fox6now.com/video/860667>

6_Boeing and Far UV Technologies Enter a Licensing Agreement for Ultraviolet Wand Technology

<https://finance.yahoo.com/news/boeing-far-uv-technologies-enter-204300838.html>

7_St Andrews University and Ninewells Hospital in Dundee

<https://www.thecourier-co-uk.cdn.ampproject.org/c/s/www.thecourier.co.uk/fp/news/politics/uk-politics/1664281/potentially-game-changing-st-andrews-university-and-ninewells-hospital-covid-19-research-raised-in-commons/amp/>

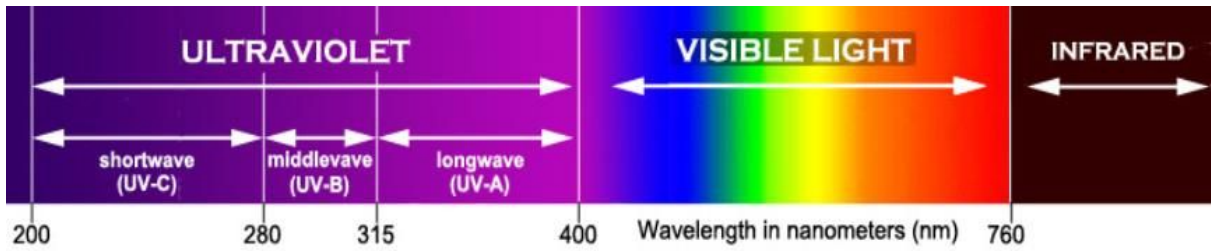
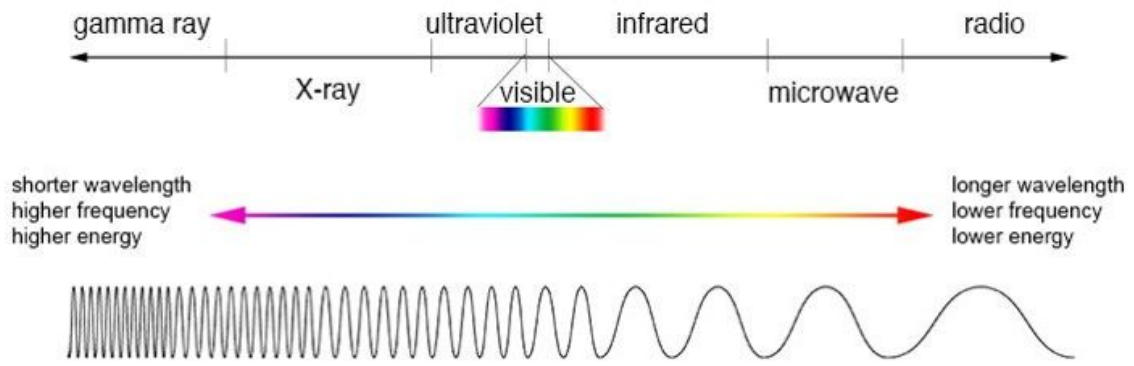
8_BBC <https://www.bbc.com/news/business-54628433>

"Far-UVC light kills microbes, but is harmless to humans," says Dr Alex Berezow, a microbiologist at the American Council on Science and Health.

9_DocWire News: Predicting airborne coronavirus inactivation by far-UVC in populated rooms using a high-fidelity coupled radiation-CFD model

<https://www.docwirenews.com/abstracts/predicting-airborne-coronavirus-inactivation-by-far-uv-c-in-populated-rooms-using-a-high-fidelity-coupled-radiation-cfd-model/>

10_ <https://blooloop.com/technology/in-depth/far-uv-c-technology-attractions-covid-19/>



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