

# TURN ON THE STARS



**Nekane Sandoval Diez** (student assistant), **dr. N. E. Chisari** (Department of Physics, Utrecht University), **in collaboration with Sonnenborgh Museum and Observatory**, **dr. Peter van Capel** (Physics practicals coordinator & Lecturer for Waves and Optics course) and **dr. Anke Huss** (Exposome Hub & Department of Population Health).

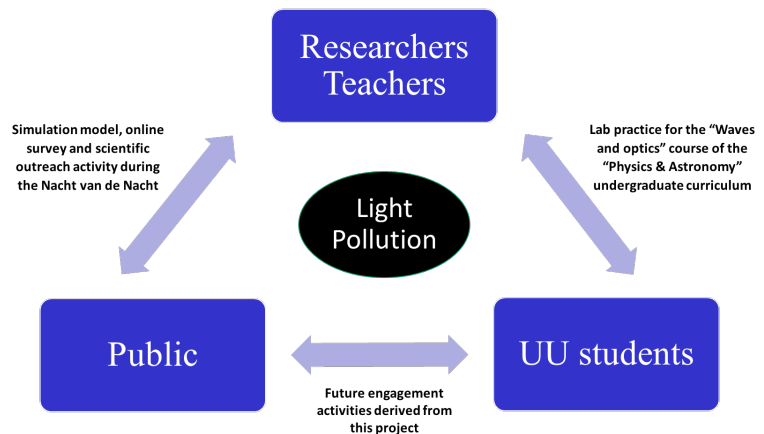
## Background

Light pollution refers to the alteration of the normal amount of light at night due to artificial lighting; skyglow is its most recognizable form and it occurs when light is emitted above the horizontal angle and scattered by aerosols in the atmosphere, making the night sky brighter than the astronomical objects we would like to observe. Today, more than 80% of the world population lives under light-polluted skies, and although the Milky Way should be visible to the naked eye, in approximately 43% of the Dutch territory this is no longer possible [1].

Excessive and misdirected lighting has resulted in polluted night skies with unexpected and unprecedented effects on flora, fauna, and human health. Furthermore, the loss of visibility of the night sky undermines efforts to encourage scientific curiosity, especially in the younger generations, since astronomy can introduce youngsters to the scientific method and science literacy. During the second half of 2021 and with the aid of the Community Engaged Learning Program, we have designed and carried out educational activities, both for the general public and university students, to raise awareness about this environmental problem and promote the awareness, implementation and development of possible solutions within our community.

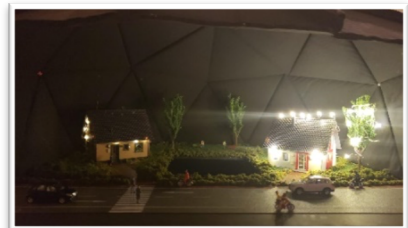
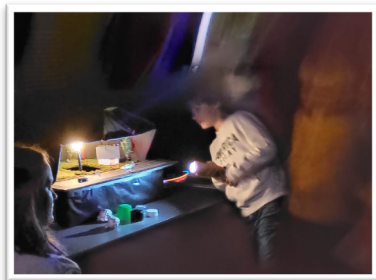
## Project description and configuration

To address this societal challenge, we have developed educational activities within a three-way learning and working framework among university students, researchers/teachers, and the public.



## Simulation model and scientific outreach activity during the Nacht van de Nacht

The activity was carried out during the Nacht van de Nacht on October 30, 2021, with an audience of 120 people, and was aimed at children from 6 to 12 years old together with their parents. The objective was for visitors to recognize the effect of skyglow on the night sky and how it affects astronomy and the visibility of astronomical objects. The light pollution model consists of a geodesic dome that simulates a perfectly dark night sky, an urban setting where we can observe situations where light is necessary at night (for example in the pedestrian crossing and, in a park), light sources that pollute the night sky (2 flashlights simulating streetlights and ornamental lights decorating the houses) and a star projector.



correctly direct light downward and reduce light spill, so that they could continue to observe the stars at night

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while still using lights. We addressed the importance of thinking about good lighting solutions and implementing this in their daily life, as well as reducing the use of light at night or using it consciously [2].

## Information leaflets and online survey on the perception of light pollution by the public

During the Nacht van de Nacht we complement the activity with two leaflets [3, 4], one for adults and one for children, so that visitors could take home more information about light pollution. The leaflets contained information on the importance of light pollution as an environmental problem in our community and provided knowledge on what it is, its recognizable forms, the situation in the Netherlands, and solutions for efficient lighting. For the children's leaflet, educational games were included through which they could learn concepts about light pollution and learn to recognize this problem.

A QR code was included in the adult leaflet to answer the online survey, which was considered a suitable method to explore their perception of the problem in their community. However, the response was very low and thus the survey data is not useful for exploring this question. We think that the low response may be because the event in the Observatory was mainly aimed at children and the visiting adults were not adequately engaged. We believe that other spaces should be sought to disseminate the survey among the interested adult population [4].



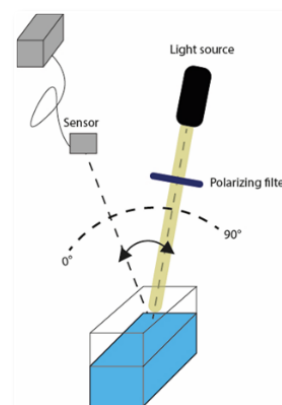
## Lab practice for the “Waves and optics” course of the Astronomy undergraduate curriculum at UU

We considered three proposals for the laboratory practice:

- Develop a practice on the measurement of light pollution using an affordable automatic device called Sky Quality Meter (SQM).
- Include information on light pollution to existing practices in which the knowledge acquired can be related to the subject.
- Add new experiments to the existing "POL1-Polarization of light" lab practice.

We decided to implement the last option due to the relevance of the topic within the “Optics & waves” syllabus and the feasibility to implement it in the following year, but we do not rule out incorporating the other proposals in the future. In particular, the former was seen as an attractive option for students to engage in activities with the public regarding their results during the practice, so this option continues as an interesting prospect for the project.

The objective of the developed lab practice is for students to recognize the polarization of light as a type of light pollution and its ecological effects. Since many animals, especially insects, can perceive the natural polarization of light and use it as a source of information, the introduction of anthropogenic elements with the ability to polarize light mimicking the natural form has important ecological repercussions [7]; for example, there is evidence that insects are deceived by red or black cars [8]. During the experiments, students will measure the reflection-polarization characteristics of water and compare it with the polarization patterns of different car paints to reach a conclusion about its potential impact on the survival of insects. We plan to further develop and pilot this activity in 2022, for which we are seeking funds within UU to support a teaching/lab assistant.



## Sources

[1] Falchi F, Cinzano P, Duriscoe D, Kyba CCM, Elvidge CD, Baugh K, et al. The new world atlas of artificial night sky brightness. *Sci Adv.* 2016;2(6):1–26.

[2] Model about light pollution (video description): <https://surfdrive.surf.nl/files/index.php/s/e2dcZvSinhKJORA>

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[3] Children' Leaflet: <https://surfdrive.surf.nl/files/index.php/s/fFqAki1ub1Rqyl0>

[4] Adult Leaflet: <https://surfdrive.surf.nl/files/index.php/s/b2l7uWXfjyPdN3Z>

[5] Light pollution survey: [https://survey.uu.nl/jfe/form/SV\\_0IBsl9LVcdzDOPs](https://survey.uu.nl/jfe/form/SV_0IBsl9LVcdzDOPs)

[6] Horváth G, Kriska G, Malik P, Robertson B. Polarized light pollution: a new kind of ecological photopollution. Front Ecol Environ. 2009 Aug;7(6):317–25.

[7] Kriska G, Csabai Z, Boda P, Malik P, Horvát G. Why do red and dark-coloured cars lure aquatic insects? The attraction of water insects to car paintwork explained by reflection-polarization signals. Proc R Soc B Biol Sci. 2006;273(1594):1667–71.