

Urban light pollution and its impact on nocturnal activity

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Researchers in Germany have discovered that urban light pollution not only limits the visibility of stars, but also plays havoc with nocturnal animals that depend on a compass-like pattern of polarised light to function. Soon to be published in the *Journal of Geophysical Research*, their study warns that screening of the celestial compass could decrease the evolutionary fitness of a number of nocturnal creatures like spiders, moths, beetles and crickets. This has the potential to disturb food webs and impact whole ecosystems.

Researchers from Freie Universität Berlin and the Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) in Germany say humans cannot see the compass-like pattern of polarised light that stretches

across the sky. It is also not visible over large areas.

"The visibility of the celestial compass is related to the degree of polarisation of skylight," lead author explains Dr. Christopher Kyba of the Institute for Space Sciences of Freie Universität. "In a natural area with clean air, the degree of polarisation of skylight is typically around [70% to 80%], and in Berlin aerosols reduce this to around 55%."

The team used a digital camera equipped with a linear polarising filter to measure the sky polarization at night. They observed that inside the city, [light pollution](#) reduced it even more, to 11%.

"Because light can travel so far in clear air, this depolarisation effect extends far outside of cities," Dr. Kyba says. "In a rural area outside of Berlin we found that the degree of polarization was still only 30%, even though the sky appeared dark to our eyes."

For his part, co-author Dr. Franz Hölker notes: "The moonlit celestial compass is believed to be an important navigational signal for several species. Nocturnal species of [beetles](#), [moths](#), [crickets](#), and [spiders](#) are believed to navigate using the celestial compass. What our study shows is that the depolarising effect of skyglow is a form of pollution with global reach."

While the results are cause for concern, they are preliminary and probably underestimate the problem, according to the researchers. "We performed these measurements on perfectly clear nights in the winter, when the full moon rises higher than it does in the summer," Dr. Kyba says. "On typical summer nights when insects are likely to be active, we expect the celestial compass to be even more obscured. In addition, Berlin and its surroundings are darker than most comparatively sized world cities."

A surprising find of the study was that urban skyglow can be polarized. "We expected the skyglow on moonless nights to be almost unpolarised, but instead found it to have a 9% degree of polarisation," Dr. Kyba points out. "Our best guess is that street canyons channel the upward directed light into beams. If this is the case, then the skyglow over grid cities in North America could be even more highly polarized."

While the researchers do not tackle the skyglow reduction in their paper, they say it is achievable without making city streets dark. "Much or most of the skyglow propagating large distances from the city is caused by lights that aren't pointed at the ground," Dr. Kyba says. "Municipalities that wish to reduce their skyglow can choose from a wide range of commercially available lamps that produce 0% uplight."

Anyone keen on modernising their outdoor lighting, including local governments, industry or even the general public, can contact the International Dark Sky Association, Dr. Kyba says.

More information: Kyba, C., et al. (2011) 'Lunar skylight polarisation signal polluted by urban lighting'. *Journal of Geophysical Research* (in press). [DOI: 10.1029/2011JD016698](https://doi.org/10.1029/2011JD016698)

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