Scientific Accommodation of the paper:
Night sky brightness simulation over Montsec protected area
https://www.researchgate.net/publication/340425652_Night_sky_brightness_simulation_over_Montsec_protected_area

Protecting our Fleeting Dark Skies; Simulating Night Sky Brightness

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Astronomers have been studying our skies for thousands of years[1] and technological developments in the past century have rapidly improved our ability to observe the galaxies around us. However, the advent of this digitally-dominated age has also brought new challenges that hugely endanger astronomers' work. The most significant of these challenges is light pollution, whereby artificial light sources illuminate the night sky excessively[2]. This is so dangerous to astronomers' work as it greatly jeopardises the availability of 'dark-skies,' special conditions where the night sky has minimal interference from artificial sources. In order to effectively combat this problem, we need a predictive tool that can accurately target which light sources are impacting our dark skies.

In the past year, a team led by Hector Linares from the University of Barcelona set out to create a model that could precisely target obtrusive sources of light impacting the Montsec Observatory, an astronomically protected area in Northern Spain. Until now, researchers had yet to create a model that could identify harmful sources of light and quantify their impacts. With this new simulator, we will now be better able to identify these sources and mitigate their impacts through more protective light designs.

A key message from Linares' research was that light pollution should be a universally recognised problem, as its negative impacts spread far beyond the work of astronomers. For example, light pollution contributes to a huge range of problems, from climate change to the spread of disease amongst humans. Another problem we face is the lack of awareness

surrounding this problem. Until now, scientists had yet to develop a quick and accurate model that could pinpoint clear sources of light pollution. Factors like volatile weather conditions and physical inaccessibility of locations across the world made it extremely difficult to find a simple, one-size-fits-all model. The two main existing models, MSNsRAu and Illumina, had several problems that made them unfit for general use. Although MSNsRAu offered relatively quick results, it was not technically advanced enough to effectively track all the incoming light sources. Left with just the Illumina model as a flickering glimmer of hope, Linares and his team sought to target its flaws and repurpose it into a faster, pinpoint-accurate model.

The Illumina model worked on the basis of acknowledging each potential source of pollution and then working out exactly how much of an impact it was having. However, as you increase the number of light sources to analyse, the time needed to produce a final result would skyrocket. Unfortunately for Linares and his team, they quickly discovered this disastrous flaw upon examining the Illumina model; its readings typically took hundreds of hours to produce, even after trying to take shortcuts to remove negligible light sources. To solve this problem, they began by examining the Illumina's existing Empirical Point Spread Function (PSF), a system that identifies the main contributors of light pollution. To add to the team's complications, they found that the PSF was totally unfit for purpose as it had been designed using Las Vegas as its source, meaning it entirely different specifications numerous factors, including light levels and weather conditions. A complete overhaul was needed.

Seeing this new problem, Linares's team had a revelation. Instead of using an inaccurate, one-size-fits-none PSF, the team devised an entire set of new PSFs that could be used all across the world, with an array of specifications to make them usable in different locations and conditions.

Thanks to the work of Linares and his team, researchers across the world will be able to implement the newly improved Illumina model and detect light pollution levels with far greater accuracy. This information will be so critical in the battle to contain artificial light sources' widespread damage, helping us to protect not only our ecosystems, but also people's livelihoods and wellbeing.

References:

1. "Science/Nature | 'Oldest Star Chart' Found." BBC News. BBC, January 21, 2003. http://news.bbc.co.uk/1/hi/sci/tech/2679675.stm.
2. "Light Pollution." International Dark-Sky Association, February 14, 2017. https://www.darksky.org/light-pollution/.