STEFAN WALLNER

Institute of Construction
and Architecture
Slovak Academy of Sciences

Project number
1384/03/01

Project duration
9/2022 - 8/2025

BIOGRAPHY

Dr. Stefan Wallner is holding a doctoral degree in astronomy, finished at the University of Vienna in 2020. His research field includes the topics of measuring, modelling and quantifying light pollution, skyglow and atmospherical effects. In detail, he brings specific expertise regarding a uniting of observational and theoretical approaches, being well versed in remote sensing devices, digital imaging and simulations on the subject. His work furthermore includes the protection of the natural night sky and public outreach. He is member of the International Astronomical Union, executive board member of the Austrian Society for Astronomy and Astrophysics and chairman of the astronomical public outreach association 'Burgenlaendischer Arbeitskreis Astronomie'.

"The decision to apply for a SASPRO 2 fellowship was easy and logical, since the Institute for Construction and Architecture at the Slovak Academy of Sciences hosts one of the world's best research groups in the field of light pollution, focusing especially on theoretical modelling for urban analytics. Together with this group and within the SASPRO-project, we will work together in order to achieve further progress against the phenomenon of light pollution and study the impact of artificial light at night harmful for human health, wildlife and nature. Personally, the fellowship prepares me optimally for a long-term research career in the field worth striving for, since it is one of the most pressing problems during times of climate change and inevitable environmental protection, concerning our society for the next generations to come. Furthermore, the inclusion to the SASPRO network illustrates that the issue, mainly caused by urban environments, is highly interdisciplinary and consequently raise awareness in a great variety of research areas.

PROJECT SUMMARY

Measuring and Modelling Light Pollution (MEMOLIPO)

This project aims to investigate various approaches in measuring and modelling of the global phenomenon of light pollution, artificial light at night which is misdirected, over-illuminated and/or makes use of harmful light. The ever-worsening phenomenon impairs not only the visibility of objects on the night sky, furthermore it is a major threat for all organisms worldwide, including human health suffering from impacts. Research goals of MEMOLIPO include a greater understanding of atmospheric impacts on the night sky brightness and how currently used measurement devices can show new approaches in their application. Firstly, light monitoring network data underly strong seasonal variations which can potentially falsify long-term analyses of light pollution development. Such must be included in order to rightly give statements about increases or decreases in night sky brightness values. Another research issue is the impact caused by atmospheric elements like the aerosol optical depth. Latter will be investigated by meteorological ceilometer backscatter data, providing data for this issue in an unprecedented accuracy. Furthermore, airborne vehicles will be tested as potential devices to characterize atmospheric layers. Moreover, it will be tested if easy retrievable ground-based measurements can approximate the city emission function, a very important input for theoretical modelling. And finally, all-sky measurements will show, how far light domes from light emitting cities are visible and could influence night skies above natural protected areas. Results from this project lead to important insights in the understanding of skyglow phenomena and serve as inputs for modelling approaches in the future. Outcomes shall also be used for research disciplines of other fields, since it creates new fundaments for nature related studies in, e.g., ecology, biology and environmental physics, or technical studies like lighting management, sustainability and energy saving purposes.

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PUBLICATIONS

1. Wallner S, Kocifaj M. Impacts of surface albedo variations on the night sky brightness – A numerical and experimental analysis. J Quant Spectrosc Radiat Transf 2019;239:106648.
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3. Wallner S, Kocifaj M, Komar L, Solano-Lamphar HA. Night-sky imaging as a potential tool for characterization of total lumen output from small and medium-sized cities. Mon Notices Royal Astron Soc 2020;494:5008-17.
https://doi.org/10.1093/mnras/staa925

4. Puschnig J, Wallner S, Posch T. Circalunar variations of the night sky brightness – an FFT perspective on the impact of light pollution. Mon Notices Royal Astron Soc 2020;492:2622-37.
https://doi.org/10.1093/mnras/stz3514

5. Lamphar H, Wallner S, Kocifaj M. Modelled impacts of a potential light emitting diode lighting system conversion and the influence of an extremely polluted atmosphere in Mexico City. Envrion Plan B Urban Anal City Sci 2021;49(2):501-18.
https://doi.org/10.1177/23998083211012702

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