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RESEARCH
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Have you heard about ALAN? Now, there is also ROLAN!

This article examines the new ROLAN movement and points out why this might be the next big thing for lighting professionals.

Artificial light at night (ALAN) is a term that was first used in an article published in Science News by Ben Harder in 2002 [1]. It described the noticeable effects of artificial light at night on ecology, then a few months later, another researcher, Ben Clarke, used this term when investigating outdoor lighting and crime [2]. ALAN was also used in the context of astronomy in 2004, by Kohei Narisada and Duco Schreuder, in their Light Pollution Handbook [3]. As years passed by, numerous researchers began to refer to this term and there is even an ALAN Research Literature Database [4]. However, it took another decade for ALAN to become a larger movement. This began in 2013, when the first ALAN conference took place in Berlin/Germany (arc reported about this event at the time) [5]. Following this, a series of conferences were held in Leicester, UK; Sherbrooke, Canada; Cluj-Napoca, Romania; and Salt Lake City, USA. Then more recently, two conferences were held online, due to the Covid-19 pandemic. The next conference is planned for 2023 in Calgary, Canada. The ALAN conference series is dedicated to examining all aspects of artificial light at night. The broad scope of the conference includes how light is produced (e.g. technologies, industry, and lighting design), where it is present (e.g. remote sensing); what effects it has on humans and the environment (e.g. ecology); how it is perceived by the public (e.g. perceptions of safety and security), and how the benefits and detriments of lighting may be better balanced, controlled and managed by regulations.

More recently, in the general consciousness, the term ALAN has been connected to the work of the International Dark Sky-Association (IDA), a non-profit organisation, whose mission it is to protect the night from light pollution [6]. The IDA is known for its award-winning International Dark Sky Places (IDSP) programme that encourages communities, parks and protected areas around the world to preserve and protect dark sites through responsible lighting policies and public education, as well as via their Fixture Seal of Approval (FSA) programme, global conference series Under One Sky, and other initiatives.

The term ALAN was also used in 2021, in conjunction with the work of the Artificial Light at Night Working Group, which gathered 20 experts from various fields to participate in the "Dark and Quiet Skies for Science and Society II" conference, which was co-organised by the United Nations Office for Outer Space Affairs (UNOOSA), the International Astronomical Union (UIA) and the Government of Spain. After the event, the main results of the conference were published in the Dark and Quiet Skies II Working Group Reports [7]. Interestingly, the International Commission on Illumination (CIE) [8], which is the international authority devoted to worldwide cooperation and the exchange of information on all matters relating to the science and art of light and lighting, colour and vision, photobiology, and image technology, never recognised and adopted this term in their vocabulary (the terms and definitions contained in the international standard CIE S 017:2020 ILV: International Lighting Vocabulary, 2nd edition) [9]. Considering their role, it's crucial that the term ALAN is recognised by the CIE and other lighting bodies, and that this occurs in the very near future in order to reduce the light pollution produced by ground-based lighting installations; this is necessary to support night-time professional and amateur astronomical observations, undisturbed human sleep, and the correct functioning of flora and fauna.

Although the ALAN movement and the ideas behind it are very valuable and important, it involves quite an enclosed circle of researchers whose recent findings are often highly scientific, with very little direct applicable knowledge for lighting professionals.

Additionally, the language and physical quantity/ measurement units used differ from those that lighting professionals currently apply in their daily practice, which also hinders communication and the application of these new research findings (Table 1).

Today, there is an awareness of water, air, and soil pollution and the impact that they have on the entire biosphere, including humans, flora, and fauna. However, artificial lighting as a pollutant

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| Physical Quantity | Lighting Professionals | ALAN Researchers |
|--|------------------------|-------------------|
| Irradiance, E_e (W/m^2) | Rare | Common |
| Illuminance, E_v (lx) | Common | Rare |
| PAR* photon flux density (PPFD) EPAR ($\mu mol\ photons/m^2$) | Not Used | Rare |
| Radiance, L_e ($W/m^2 \cdot sr$) | Not Used | Rare |
| Luminance, L_v (cd/m^2) | Common | Not Used |
| Sky radiance (astronomy) L_{sky} , SQM (mags/arcsec ²) | Not Used | Rare |
| Radiant flux, Φ_e (W) | Not Used | Rare |
| Luminous flux, Φ_v (lm) | Common | Rare |
| PAR* photon flux (PPF) Φ_{PAR} ($\mu mol\ photons/s$) | Not Used | Rare |
| Spectral power distribution (SPD; e.g., spectral irradiance in $W/m^2 \cdot nm$) | Rare (increasing) | Rare (increasing) |
| Correlated colour temperature (CCT; K) | Common | Rare |
| Colour rendering index (CRI; Ra) | Common | Not Used |
| Flicker frequency | Rare (increasing) | Not Used |
| Flicker % | Rare (increasing) | Not Used |
| (Degree of) Polarisation | Not Used | Just Emerging |

Table 1. Overview of the usage of terms that describe the physical quantities of artificial light by lighting professionals versus ALAN researchers, modified from [10]

has been neglected for a long time and only recently has it been considered a potential pollutant.

There's no denying that lighting professionals need to educate themselves – when they are better educated, the benefits of this extend to everyone, not only human beings but the entire ecosystem.

With the recent climate change emergency and environmental degradation, a different approach to designing outdoor lighting is necessary, instead of relying upon the outdated, traditional, human-centred approach that lighting professionals have used in the past. This involves a new paradigm shift in exterior illumination that provides responsible outdoor light at night in order to protect planet Earth, and to also transform the existing world into a healthier environment. The immense challenge for the implementation of the above goal involves skilful lighting design based on a foundation of solid research, so the negative aspects of

outdoor lighting on the environment, public health, wellbeing and life quality are minimised. This inspired me to think about the most effective and practical way to educate lighting professionals. It seemed necessary to have a dialogue with ALAN experts, and to also translate the scientific research and complex knowledge into easy-to-understand information.

Out of this need, the Responsible Outdoor Lighting at Night (ROLAN) movement was established in 2022, with the first conference held online [11]. This two-day event gathered not only well-respected ALAN researchers but also esteemed lighting professionals whose recent work is more environmentally conscious and sensitive to protecting dark skies and the nocturnal landscape. This platform provided a new form of communication and exchange between these two divergent groups, as well as the possibility of presenting their work and sharing their unique knowledge.

ROLAN 2022 was organised by the ILLUME research group from the Gdansk University of Technology, Poland, [12] and the Society of Light and Lighting (SLL) from the UK [13]. There were also other Founding Partners that were invited to join this movement, including the International Dark-Sky Association, the International Association of Lighting Designers [14], the Illuminating Engineering Society [15], the Institution of Lighting Professionals [16], and the Lighting Industry Association [17].

ROLAN 2022 Takeaways

ROLAN 2022 was born out of the need to facilitate a much-needed collaboration, and to offer the support necessary to improve lighting practice, enhance research, and provide networking opportunities between practitioners, researchers and manufacturers. The conference was held over two days between 12-13 May 2022, with stimulating talks and panel discussions that involved 32 speakers from around the world. An interdisciplinary format was used for the event, which allowed for an increased understanding of ROLAN topics [18]. These talks were divided into four dedicated sessions. In session one: Losing our dark nights – the audience heard from astronomers and astrophysicists about the extent and consequences of light pollution from urban environments. In session two: called Best lighting practice(s) to reduce light pollution – experienced lighting professionals used different case studies to explain and demonstrate the various ways in which we can minimise the impact of outdoor illumination, by reducing light pollution. In the third session: Light pollution legal aspects – the participants learned about the legal frameworks and light pollution laws and guidelines that exist in different countries, including Slovenia, Germany, France, Poland, and the UK. In the fourth session: The impact of light exposure at night on the environment and humans – researchers discussed the negative consequences of improperly designed outdoor illumination on nature and all living beings. Each one of the four sessions was summed up with panel discussions to point out the most important findings. In the afternoon of the last day of the event, representatives of the ROLAN Founding Partners had the opportunity to give their feedback on the event, and to also explain the reason why each organisation decided to support the ROLAN conference and movement.

According to Ruskin Hartley, CEO and Executive Director of the International Dark-Sky Association (IDA): "It has been absolutely fascinating, almost like a university-depth course. There seems to be a violent agreement in terms of what needs to be done, in terms of high-level principles. We have

some wonderful examples of projects from around the world, where in a sense money is no object, so you can bring the right people and the right team together to get this right. There also appears to be an agreement on the real challenges. How do you get this out to scale, how do you take it out beyond the design community, down to the consumer level? How can we take this energy and make it simple and actionable for anyone who wants to be part of the solution? The other key message that came out of the conversations was how do we make this an emotional issue that everyone cares about? For IDA, that is why we have been involved in this. The conference brought the whole world together to talk about this set of issues. How do we take it forward so that the growing number of people around the world, who want to be part of the solution have access to the tools and resources that they need? To talk to their neighbours, to talk to their communities, to talk to officials about the steps they can take. I hope this is just the start of the conversation as we move forward together to put the right tools in place."

Andrew Bissel, President of the Society of Light and Lighting (SLL) said of the conference: "It was fascinating, there is so much information that has been shared with everyone. From an SLL point of view it is something that has become a topic that we want to take further and explore with our lighting guides. We have LG21 Protecting the night-time environment [19], which is designing for dark skies, but we need to expand on that. We need to start looking at all of our lighting guides, such as the office lighting guide - office lighting its current brightness, when it is left on at 4pm, emits a huge amount of light into the streetscape and into the night sky. We need start putting a Dark Sky section into every lighting guide that we have within the SLL and get people to understand the sheer scale of the impact that every building has. When you add up each building, the school, the hospital, the offices, not just the public realm and roads - we have a huge problem with too much light at night. So, from an SLL point of view, if we provide the right advice and the right education, we will bring about change, so it was absolutely important that we were part of ROLAN."

Bob Bohannon, Head of Policy & Academy of The Lighting Industry Association (LIA) highlighted the need for this kind of event, saying: "Part of what we do at the LIA is we teach. We communicate with the Government, with manufacturers and out to local authorities. How do we take these emotional methods and explain what we have to achieve? ROLAN was a great two days of joining up the gaps so we can make this real, street by street, town by town."

Monica Luz Lobo, President of the IALD, added: "It's an honour to support this

opportunity to give light to this topic with this highly skilled line up of panelists. We are sure the collaboration between research and practice is key to deliver excellence in lighting and to improve human light."

Susanne Seitinger, President of the IES, considered this event to be a great opportunity: "IES's mission statement is to improve the lit environment by bringing those together with lighting knowledge, and by translating that knowledge into actions that benefit the public - and I think everyone here has talked about how what we do has a significant impact on urban life, on home life, on health and wellbeing. Emerging from the pandemic, I felt this strong new resurgence and interest in how people structure their environments. We all had to, for better or worse, figure out how to create environments that are healthier, that we can inhabit 24/7 in very different ways - and now thankfully, we are able to re-inhabit the public space too, which is the most important part, because this is where we find connections."

Lastly, Graham Festenstein, Vice President of the ILP, said: "This has brought together different disciplines and specialisms across lighting and has facilitated great discussions. Collaboration is really important, and hopefully this will kickstart more collaboration between us all. At ILP, our role is furthering best practice in exterior lighting, and the environmental impacts have been important to us for many, many years. As a professional body, from a practical perspective we want to collaborate, we want to be able to work with our research colleagues who can give us the evidence. What we want is evidence-based research, and to incorporate this into best practice, and our application guidances - and with that, hopefully influence standards. And that follows on, in terms of being able to bring the evidence to policy makers, politicians and the public. Lighting strategy is a social and political project and I think that really sums up our view as a professional body - and it's one of our priorities."

What next?

At the moment, seven Founding Partners are working on the ROLAN manifesto, and this declaration will be presented to the lighting community in October 2022 during Light + Building in Frankfurt.

The SLL are in the process of making all recordings from the conference available to be purchased on demand, so all this knowledge will soon be available to a wider audience.

There was also a special issue of Light Lines from the SLL on the occasion of the ROLAN 2022 conference, with written contributions from selected participating experts in lighting design, biology, medicine, astronomy, and public engagement [20].

ROLAN was possible with the financial support of four dedicated sponsors. Diamond sponsor:

Thorn Lighting from the UK, Gold Sponsor: Filix Lighting from Croatia, and two silver sponsors: GL Optics from Poland, and Selux from Germany.

There are also other lighting manufacturers who are adapting their products based on recent ALAN research in order to provide lower CCT options, along with reduced blue light content, directional, full cut-off and fully shielded luminaires with integrated lighting controls, and this trend continues to grow. It will be interesting to see what the lighting industry is going to present during Light + Building this year, and if spectral power distribution (SPD) and flicker will be considered in the luminaires exhibited at the event.

For more information about ROLAN 2022 event please contact Conference Chair:

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