

# Casting a Light on Dark Sky Awareness in Madeira

## Pedro Augusto

Universidade da Madeira/  
Centro de Astronomia e Astrofísica da  
Universidade de Lisboa  
augusto@uma.pt

## Ilídio Andrade

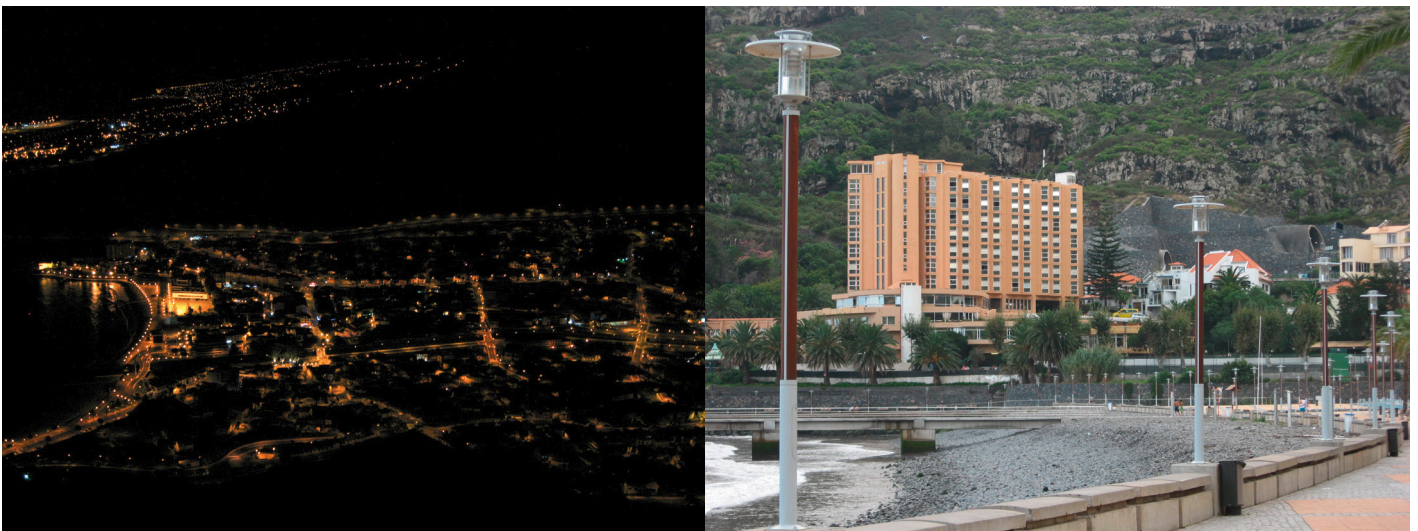
Universidade da Madeira  
ilidio.andrade@sapo.pt

## Keywords

IYA2009, Dark Skies, Light Pollution

## Summary

We have implemented Dark Sky Awareness — one of the Cornerstone projects of the International Year of Astronomy 2009 — in Madeira with an initiative called *O céu estrelado existe!* (*The Starry Sky Exists!*). Eight of the 11 municipalities in the region took part (260 000 inhabitants), with 356 people attending the events. Six talks were given and eight organised blackouts covered a total area of 112 km<sup>2</sup> (14% of Madeira's land area).



**Figure 1.** Bad lighting and good lighting in Machico: at night we can see that most of the light pollution is concentrated near the coastline. By day, we can see the type of modern lighting that is responsible for this problem. Credit: P. Augusto and I. Andrade

## Dark Sky Awareness

*O Céu estrelado existe!*<sup>1</sup> is the title that we chose for our Dark Sky Awareness<sup>2</sup> project in Madeira. The programme involved a talk on light pollution followed by an observation session: 30 minutes with public lighting on, 30–60 minutes of blackout and then another 30 minutes with the lights on again. The aim of this was to show people the effect of light pollution on our ability to see the star-filled night sky.

Our original plan was to introduce this programme to all 11 of the municipalities

of Madeira, 19% of which is covered by UNESCO World Heritage Forest. However, we only managed to include eight: Ribeira Brava, Santana, Porto Santo, Câmara de Lobos, Porto Moniz, Calheta, São Vicente and Machico.

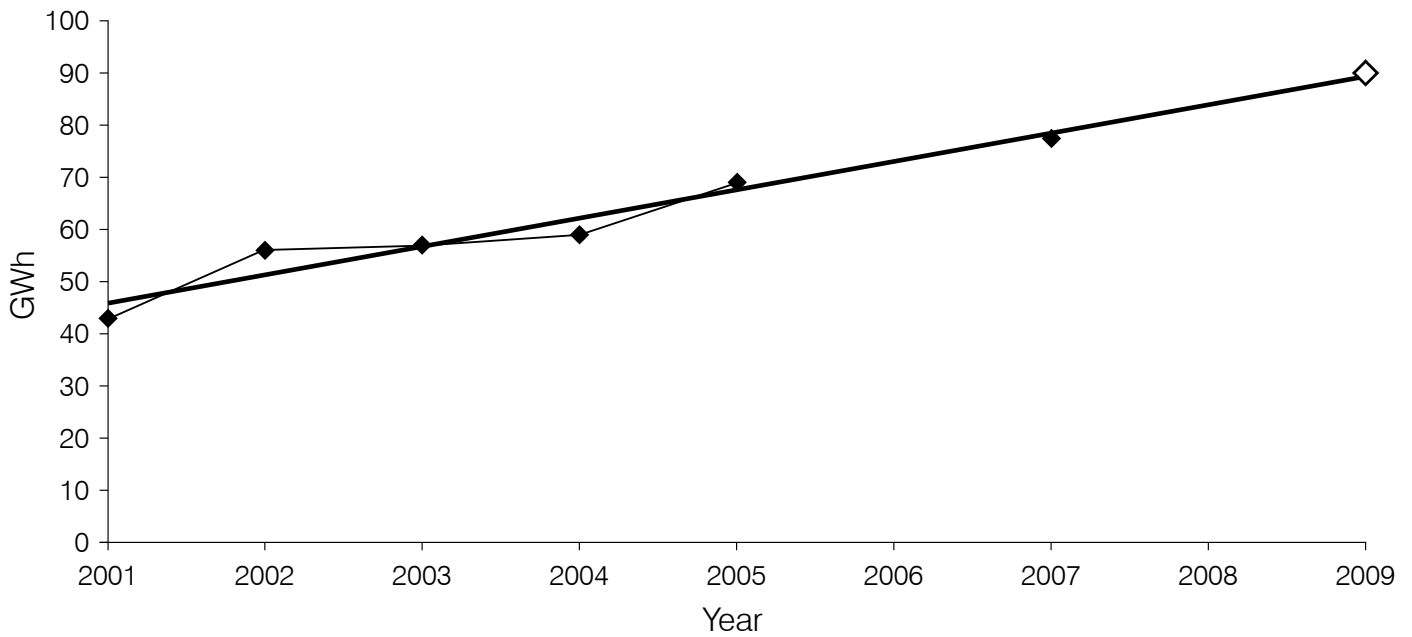
## The talk

Since one picture is worth a thousand words, we decided to photograph each municipality to obtain evidence of the effects of light pollution. We also went out by day and photographed some examples of poorly

designed lights that are responsible for this pollution (Figure 1).

These photos were presented during a talk<sup>3</sup> on efficient illumination given in the Mayor's House for six of the municipalities. (In Porto Santo and Câmara de Lobos the speakers were unable to present their talks as no members of the public showed up.)

In addition, data from the Madeira Electrical Company reports<sup>4</sup> from 2005 and 2007 were presented, showing how much power each municipality uses for public lighting, its cost and the amount of carbon dioxide emitted.



**Figure 2.** The growing energy consumption needed to feed public illumination on the island of Madeira. Data points from 2001 to 2007 show real values, while the 2009 point was extrapolated from the data up until 2005. The data for 2007 was accessed after the extrapolation was made, and was found to support the expected values for 2009. Credit: P. Augusto and I. Andrade



**Figure 3.** A very dark sky in the Santana municipality during a blackout. The sky brightness reached 20.2 mag/arcsec<sup>2</sup> at the zenith: almost eight magnitudes below the value achieved when all of the public lights were on. Credit: Sandro Correia

The information that 87% of the electrical power in Madeira comes from diesel burning was noted. We also presented our estimates for the amount of wasted energy that is directed up to the sky.

Using data for the energy consumption on Madeira from 2001 to 2005, values were extrapolated to 2009 — the year of the talks (Figure 2). At a later stage, data for 2007 was available and was found to be in agreement with the extrapolated results.

### The blackouts

In addition to the talks, mini blackouts of up to an hour in the most illuminated part of each municipality (usually the centre) were held, and proved to have a big impact in attracting the attention of the local media. These took place either on the day of the talk or on the following day.

In Câmara de Lobos and São Vicente, the sky was cloud-covered, but there was still a noticeable difference in the amount of light reflected back from the clouds. At the other six sites, attendees were able to observe Jupiter and Saturn and their moons, star clusters, nebulae, and even galaxies. Measurements of the sky brightness were taken using a Unihedron device<sup>5</sup>

Date	Municipality	Exact place	Area (km <sup>2</sup> )	Sky brightness (zenith) (mag/arcsec <sup>2</sup> )		
				Lights on	Lights off	Difference
9 May	Ribeira Brava	Sea side	3.1	17.98	19.05	1.07
20 May	Santana	Mayor's House	18	12.58	20.20	7.62
22 May	Porto Santo	Mayor's House	42	17.45	18.26	0.81
9 Jun	Câmara de Lobos	Municipal garden	3.1	---	---	---
20 Jun	Porto Moniz	Sea side	3	17.22	19.72	2.50
18-19 Jul	Calheta	Sea side	1.5	15.87	19.95	4.08
13 Aug	São Vicente	Mayor's House	21	---	---	---
17 Oct	Machico	Sea side	20	18.62	20.14	1.52

**Figure 4.** Measurements of the sky brightness at the zenith taken during the blackout sessions. Measurements were not taken at the two cloud-covered sites: Câmara de Lobos and São Vicente. Credit: P. Augusto and I. Andrade

(see Figure 4), with the data announced to the public during the blackout sessions. In some cases, the light pollution was obviously worse than in others: ranging from  $\sim 13$  mag/arcsec<sup>2</sup> for the brightest value in Santana to the fairly good measurement of  $\sim 19$  mag/arcsec<sup>2</sup> in Machico. For comparison, a perfect dark sky, with no light pollution, would have a brightness of 21.6 mag/arcsec<sup>2</sup> (IAU Report, 1978).

All of the blackouts were extensive, covering several square kilometres on the ground, although restricted to public illumination. The largest area covered was at Porto Santo, where the public illumination was turned off across the entirety of this small island (42 km<sup>2</sup>). The total area covered by all of the municipalities reached nearly 112 km<sup>2</sup> (14% of the total area of Madeira).

## Conclusion

In total, 356 people attended the talks and blackout events, including 14 politicians. The long-term impact of *O Céu estrelado existe!* is hard to predict. However, as part of its legacy, we are currently submitting a funding proposal for a new project with a consortium that includes two of the municipalities that took part in *O Céu estrelado existe!*, as well as the Madeira Electrical Company.

Following this project, we have since found it much easier to negotiate localised black-

outs with the Madeira Electrical Company, as they now understand what we are trying to do. For example, a blackout was organised at the university in Funchal during our Astronomy Week in 2010 (Augusto & Sobrinho, 2012).

Observing sessions that include blackouts are a great way to attract the general public to participate. This is becoming a popular way to observe in light-polluted areas, with the local amateur astronomy association now using this format<sup>6</sup>.

## Acknowledgements

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## References

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- IAU Report 1978, Report and Recommendations of IAU Commission 50 (Identification and Protection of Existing and Potential Observatory Sites)

## Notes

- <http://www3.uma.pt/Investigacao/Astro/AIA2009/ceuestreladoexiste.htm>
- <http://www.astronomy2009.org/global/projects/cornerstones/darkskiesawareness/>
- [http://www3.uma.pt/Investigacao/Astro/AIA2009/Files/palestra\\_apagao\\_CLobos.pps](http://www3.uma.pt/Investigacao/Astro/AIA2009/Files/palestra_apagao_CLobos.pps)
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## Biographies

**Pedro Augusto** is Aggregate Assistant Professor of the University of Madeira (UMa) since 1998. As regional coordinator for IYA2009 in Madeira, he organised over 200 science outreach events, including hands-on lab activities, observing sessions, exhibitions, multimedia presentations, and talks. He has 15 years of experience in teacher training and communicating astronomy to the general public and students.

**Ilídio Andrade** graduated at UMa in Instrumental/Electronic Engineering Astronomy working on an Astronomical Seeing and Observatory Site Selection project at Madeira, including innovation (one patent). He has been an active collaborator in the Astronomy Group of UMa since 2006 and particularly in the IYA2009-Madeira, where he took part in 70 events.