

Gabriela Mistral International Dark Sky Sanctuary 2016 Annual Report

I. General

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Site Management Team

- Lighting Expert: Pedro Sanhueza

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- Educational Program Lead: Dr. Stephen Pompea

Head of NOAO EPO Program

II. Lighting

AURA has done general work on the implementation of the Lightscape Management Plan (LMP) for the Gabriela Mistral (GM) International Dark-Sky Sanctuary, and Malcolm Smith and Pedro Sanhueza from the Site Management Team have completed their annual review of aspects of site lighting.

The most significant activity on the site has been the significant advance in the construction of our new facility, the Large Synoptic Survey Telescope (LSST). As of this writing (September 2016), the telescope enclosure building is approximately 50% complete. Conversations have begun on how to make the LSST building more than just compliant, but a model for good lighting. The LMP has been provided to the LSST architect for inclusion in the final stages of construction of the building.

Specific Areas of Interest/Concern

We have one point on stairs on Cerro Tololo between a parking lot and the main restaurant/bedroom area where lighting could, at first sight, be seen as non compliant – the attached photo (Figure 1) shows the bare, red light bulb. However, on a dark night where the zodiacal light and the Milky Way seem to provide adequate visibility for walking across the parking lot, the red light reflected off the walls of the stairwell and the stairs in that well – in our judgment – helps improve safety for a person walking in that immediate area. For this safety-related reason, have decided to leave that light bulb as is.

Building maintenance staff have been trained to leave curtains closed in unoccupied rooms, even in daytime, as a signal to those who arrive to be aware of their need for careful use of lighting. A recent spot check (in August, 2016) shows, however, that we still need improvement in this area. We found three rooms with lights on and curtains not drawn (all in areas below the telescope area). This may be because this daytime view is a wonderful view over the Andes and of the local wildlife on the ground. The worst case of light trespass that we found that evening was our first-aid/emergency room (Figure 2), but we did not find any evidence of an emergency.

In addition, we still have old, unused lighting fixtures that need to simply be removed to ensure the perception of compliance.

III. Communities

We have recently begun a training program with the Chilean Astronomical Society (SOCHIAS) concerning the new and improved Chilean national government lighting norm for northern Chile, Supreme Decree 043 (DS043). This program concentrates initially on the municipalities whose lighting can be detected on the horizons from Cerro Tololo and/or Cerro Pachón. The first of these training sessions took place in Coquimbo on 23rd July (2016) for the Municipalities of Coquimbo and La Serena. Observers from the Municipalities of Combarbalá and Monte Patria also took part. These communities will soon have their dedicated training session along with the Municipalities of Limarí y Choapa.

Following significant work by the OPCC (Pedro Sanhueza) and the national Fundación Chilena de Luminotecnica, the XIII Congreso Panamericano de Iluminación – LUXAMERICA 2016 will be held in late November in La Serena, Chile. The Congress will include highlighting sustainable lighting for Latin America. This meeting will be an excellent opportunity for us to

connect with nearby lighting end-users and with the companies that provide lights to them. See <http://luxamerica.org/>.

We have now made initial contact with the director of Hacienda de los Andes (a local, dark-sky, public observatory) and with the Municipality of Rio Hurtado to see if and when we can make a coordinated proposal to the IDA to have the area added as a Dark Sky Park or Reserve. This addition might be the first increment in a buffer zone around the Gabriela Mistral International Dark Sky Sanctuary. Work will first be required on some of the village lighting in this Municipality.

IV. Sky Quality

We are expanding our efforts to monitor sky quality. Figure 3 shows this month's (August 2016) all-sky image taken by Pedro Sanhueza from the summit of Cerro Tololo. We have now started to install imaging systems at several of the AURA-O telescopes (that include ground as well as sky so as to provide the option of monitoring (at least spatially) the key sources of light pollution around the observatory. For example, the Gemini South telescope now produces a 1-minute, high-resolution, nightly, digital movie for each of three key directions from the Gemini dome on Cerro Pachón. These short videos, which are displayed in the telescope control room and recorded each night, are also powerful outreach opportunities. However, each movie takes over 100MB of storage space, so we are considering the best longer-term method to keep just a subset of the most useful records (e.g. those obtained on clear, new-moon nights) in order to create a compact, highly usable archive

Our most recent set of Sky Quality Meter (SQM-L) readings from the summit of Cerro Tololo were made at New Moon in August 2016:.

- Zenith: Towards visually darkest part of the sky (~30 deg zenith distance, NNW): 21.7mag
- Correction to V band: ~0.13mag.

The corrected sky brightness reading was ~21.8mag with residual correction for any remaining part of the Milky Way including foreground stars in the aperture still needed. To get a reliable correction for the Milky Way and the Zodiacal light we should have made the SQM sky measurements throughout the night instead of just doing photography in the second part. A better time to make such SQM measurements is in January when the weather is optimum and the Galactic Center doesn't

dominate such a large area of the sky. This will also make it easier to avoid the zodiacal light. Figure 14 of our original proposal illustrates this point. We remain aware, however, of the need to keep the manual measurements as straightforward as possible to ensure consistency until we have simple quantitative monitoring systems installed that have proven reliability.

V. Conservation and Research

We continue biological research and outreach work in the region in collaboration with The Center for Advanced Studies of Arid Zones (CEAZA, <http://www.ceaza.cl>), especially in the area surrounding the Dark Sky Sanctuary. Our goal is encourage eco-tourism and the preservation of the skies of these regions. CTIO is part of the national program “Comunidades Sustentables” (<http://www.ceaza.cl/2016/09/09/mas-de-200-educadores-ambientales-aprenden-contenidos-para-trabajar-por-el-desarrollo-sustentable/>) and works with the “Protegiendo la Calidad de los Cielos de la Region de Coquimbo” .

VI. Funding

Funding comes from a combination of AURA and Chilean-government resources. The most recent new example is the launching (in mid August, 2016) of a TV program broadcast on the Chilean Senate TV network covering environmental protection and light pollution and how that attracts resources into Chile from overseas. AURA is acknowledged as the principal non-Chilean-government supporter of this TV program.

VII. Arts and Culture:

Our efforts to explore the possibility of declaring sites in Chile, including the GM Dark Sky Sanctuary, as World Heritage sites (further discussed below) have an inherently cultural aspect. With public talks and in our materials, we continue to develop the message of dark skies as a national, if not international, cultural asset. We are promoting the idea that the Dark Sky initiatives are fundamentally based around protecting this heritage for future generations in Chile as well as elsewhere.

VIII Outreach:

Education and outreach in the area surrounding the sanctuary continues

as part of the core education program of CTIO, Gemini, and the other AURA programs. We are beginning a new education initiative on dark skies education using problem-based learning teaching kits. These kits were exhibited in March at the Chile Education and Outreach Summit in La Serena and were enthusiastically received. The kits were developed under the auspices of The International Year of Light (2015). The materials in these Quality Lighting Teaching Kits has recently been translated into Spanish and this material is being assembled by the outreach team in Tucson for distribution in the near future.

Our outreach programs continue to touch thousands of the Chilean public. On the grounds of the sanctuary, we hosted over 4,500 visitors in our open tours of Cerro Tololo, which happen every Saturday except for reasons bad weather, and another 300 at Gemini on Cerro Pachon. Our Gemini program hosted two massive public events, which together with smaller events had a total reach of over 10,000 people, while our CTIO program reached over 9,700 through a variety of off-site programs.

AURA also co-led, with AUI, the second Chilean Astronomy Education and Public Outreach Summit in March 2016. This meeting brought together EPO representatives from all of the international observatories, Chilean universities, Chilean museums and public institutions, and Chilean government representatives to discuss how to better communicate, coordinate, and collaborate on EPO initiatives in Chile. This second meeting was the culmination of a year of work on a “road map” document that started with the first Summit (in March 2015). As of this writing, the document is in layout and translation, and we hope to roll it out to Chilean authorities and public in the next six months.

IX Community and Media:

The announcement of the sanctuary generated a significant amount of press in Chile, with stories in regional, national, and international press. Some of the most significant media references include:

<http://www.t13.cl/videos/nacional/valle-del-elqui-asi-es-santuario-cielos-oscuros-gabriela-mistral>

<http://www.cooperativa.cl/noticias/sociedad/astronomia/primer-santuario-internacional-de-cielos-oscuros-del-mundo-es-chileno/2015-08-11/184506.html>

<http://www.emol.com/noticias/Tecnologia/2015/08/11/744455/Observatorio-de-AURA-en-Chile-se-convierte-en-el-primer-santuario-Internacional-de-Cielos-Oscuros-del-Mundo.html>

<http://www.latercera.com/noticia/tendencias/2015/08/659-642523-9-chile-contara-con-el-primer-santuario-internacional-de-cielos-oscuros-en-el.shtml>

Even after six months, the sanctuary continued to receive references, particularly in the context of ongoing efforts to protect the dark skies of northern Chile. Examples include:

<http://latinamericanscience.org/spanish/2015/12/los-cielos-chilenos-postularan-a-ser-patrimonio-de-la-humanidad-de-la-unesco/>
<http://portal.mma.gob.cl/postularan-a-cielos-oscuros-del-norte-como-patrimonio-de-la-humanidad/>

<http://globovision.com/article/astronomos-promueven-cielos-chilenos-como-patrimonio-de-la-humanidad>

We continued extensive engagement with Chilean government at both national and regional levels. Most importantly, we have worked closely with the Chilean Ministry of Foreign Affairs and the Council for National Monuments to better understand the possible path for declaration of our site as one of several astronomical sites for UNESCO World Heritage status. Together with the Chilean authorities, we hosted a noted international expert (Dr. Clive Ruggles) in his visit to Chile to help better define the criteria and methodology that might be used in a World Heritage site proposal. We've also developed a better understanding of the necessary steps within Chile to prepare for a World Heritage proposal. While we've identified significant challenges in terms of site management regulations, some of which might prevent moving forward, the process has raised awareness in many government sectors of our efforts to protect the Dark Skies of Northern Chile.

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FIGURE 1:

This photo shows the bare, red light bulb. The red light reflected off the walls of the stairwell and the stairs in that well – in our judgment – helps improve safety for a person walking in that immediate area. For this safety-related reason, have decided to leave that light bulb as is for the time being, but will explore appropriate options.



FIGURE 2:

The worst case of light trespass that we found that evening was our first-aid/emergency room, but we did not find any evidence of an emergency. More education is planned for this type of infraction.



FIGURE 3:
The August 2016 all-sky image taken by Pedro Sanhueza from the summit of Cerro Tololo.

