



Protection of Northern Chile as an ICOMOS/IAU “Window to the Universe”

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UNESCO and Astronomy

- Thanks to the work of Cipriano Marin in Spain, Anna Sidorenko-Dulom at UNESCO in Paris and others, a conference held in April 2007 on La Palma in the Canary Islands resulted in the “Starlight Declaration” which opens with the statement:-
- “An unpolluted night sky that allows the enjoyment and contemplation of the firmament should be considered an inalienable right equivalent to all other socio-cultural and environmental rights. Hence the progressive degradation of the night sky must be regarded as a fundamental loss.”



Allies in the “Starlight” Initiative.

- The “Starlight” conference included representatives of the UNWTO, the UNESCO MAB Programme, the UNESCO World Heritage Centre – and the IAU.



The First Starlight Reserve?

- Following the conference in 2007, UNESCO/ ICOMOS established a Working Group for Starlight Reserves, Astronomy and the World Heritage Initiative. This working group called for proposals from possible sites for Starlight Reserve status prior to its meeting in early 2009.
- New Zealand worked hard to make a Case Study proposal for a Starlight Reserve to surround Mt John Observatory and Lake Tekapo in the centre of the South Island of New Zealand.
- It had already been agreed in principle in 2007 to put forward the Lake Tekapo/Mount John area as a first test case.

Lake Tekapo, New Zealand



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Support from New Zealand's government

- The area around Mt John and Tekapo, extending for some tens of kilometres, is already protected in law with a lighting ordinance, and has been since 1981.
- The lighting ordinance is now part of an Act of the New Zealand parliament (the Resource Management Act) and controls the type and use of outside lighting in the Tekapo region of New Zealand.



Astronomy and World Heritage – Across Time and Continents

- In October 2008, UNESCO/ICOMOS and the IAU signed a document aimed at developing steps to protect and preserve astronomical sites having outstanding historical and cultural significance.
- Program was launched in 2009 within the framework of the World Heritage Initiative, specifically during the celebration of the IYA. (This IAU Joint Session of FM2 and FM2I is further follow up).
- The following is an update on the detailed discussion held three years ago (2012) at the last IAU General Assembly (in Beijing) which included presentation of “extended case studies”
- The UNESCO/IAU working group launched the web portal

<http://www2.astronomicalheritage.net>

as part of the latest cycle of the UNESCO-World Heritage activities with the IAU.

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What can IAU Commissions B7 and C4 do?

- Continue to support the joint work between the ICOMOS World Heritage WG & IAU C.C4 on World Heritage and Astronomy – see IAU 2009 Resolution B5.
- Support work with astronomers in Chile & the Chilean OPCC in their work with the Chilean government to help develop its part of a “nomination dossier” for use in a “serial nomination” to UNESCO.



Major, Professional, Optical Observatory Sites

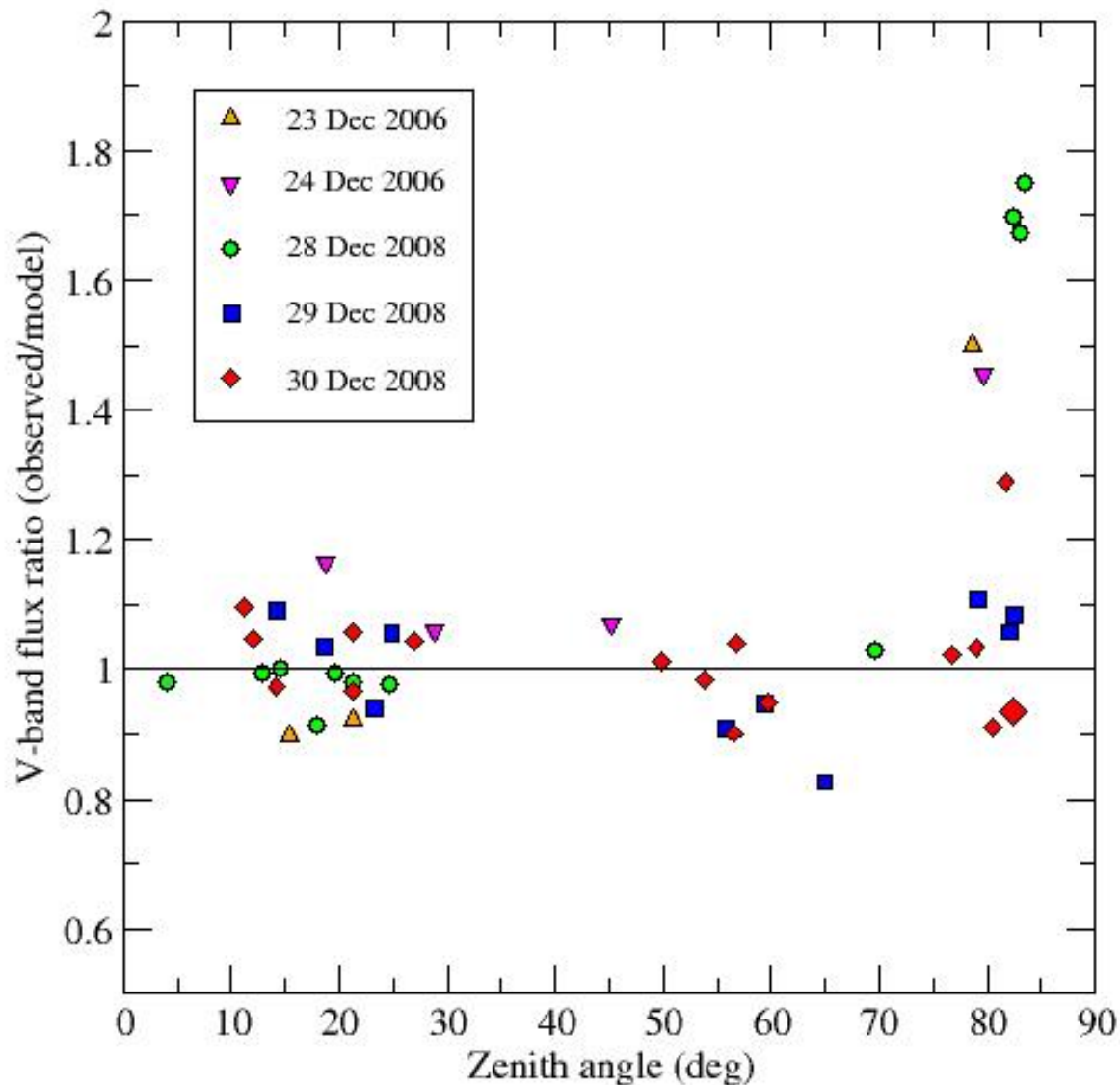
- Some initial criteria were adopted in 2006 by IAU C50 for such observatories. These serve as evidence to local authorities, as well to UNESCO and the IAU, of continuing international relevance and commitment:-
 - (a) At least one operating, international, optical telescope with effective primary aperture $>6.5\text{m}$ on the site.
 - (b) Existence of an Action Plan along the lines set out in the “Starlight Reserve Concept”, including evidence of local ordinances and/or legislation.
- Almost all the directors of such sites immediately indicated strong interest in supporting this effort.
- In the meantime, radio astronomy has continued to work with the ITU bodies as their principal international effort.

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Most major observatories have at least some glow on the horizon.

- The investments in new, large telescopes are normally so large as to demand a useful lifetime of several decades.
- Therefore, **a site now receiving a new, large, optical telescope needs to have that site under skies that will still be dark in the 2040-2060 period.** Those sites will need continued active protection, given the rapid population growth near most of the major observatories and the ever-present risk of nearby mining development in many of them.
- Chris Smith will be discussing the case of AURA-O, as one example from northern Chile.



V-band Sky
Brightness
ratio over La
Serena -
compared with
zenith values.
Ratio = 1 for
Garstang
model for
unpolluted
night sky.

V-band
measurements
made by Kevin
Kriscuinas

La Serena/Coquimbo conurbation - 63 km from
Cerro Tololo. Population is growing
at >25% per decade . Action is needed as emphasized
by Anna Sidorenko-Dulom yesterday.





Chile's current biggest challenges

- Blue-rich lighting without full cutoff.
- Blue-rich electronic billboards.
(Watching situation in Arizona)
- Shortage of funding for OPCC work in Chile related to controlling light pollution.
- Enforcement of new “norma luminica”.
- More today from Pedro Sanhueza.



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Serial Nomination?

- The Expert meeting encouraged States Parties to the World Heritage Convention to cooperate towards a potential serial nomination to cover outstanding heritage and observation sites.... (such as the Canary Islands, Chile, Hawaii).
- The serial nomination would take into account the framework to be provided through the thematic study to be developed by the Working Group on Starlight Reserves and World Heritage.



Outreach to Allies during the IYA - - and Beyond.

- Earth Day has shown some of the motivating power of energy-efficiency arguments.
- On the other hand, it is being argued that white-light LEDs are becoming comparably efficient to low-pressure (narrow-band) sodium lamps (80-160 lumens/Watt).
- Asking for acceptance of nearly monochromatic yellow light from less-efficient, less-reliable, full-cutoff, LPS fixtures is no longer easy.
- Until now, astronomy has always been able to advocate the most energy efficient options for street lighting.



LEDs and blue-white light.

- LEDs are now being used for street lighting in cities in California and elsewhere – using “stimulus funding” packages.
- Palomar and Lick observatories are among those working on this issue at local level.
- Scattering affects observatories over long distances – given the significant spectral component at the blue end of the spectrum.

Why are cities using blue LEDs? (I)

- The green and red light in low K “LED” lamps comes from a phosphor.
- The phosphor changes a higher energy (blue) photon into a lower energy (green/red) photon, producing heat.
- Heat management of the lamp mounts is a major issue for LEDs.. Cities have less thermal management issues with the high color temperature LEDs (e.g., 5500K) and get more light out.
- The problem is that a huge amount of it is blue light.

Why are cities using blue LEDs? (2)

- Many of the newer LEDs seem to have the blue bump at even shorter wavelength (450 nm), where the eye is not very sensitive.
- The high color temperature LEDs are slightly more energy efficient and are being strongly pushed for that reason.
- The reason they produce more light is that at the core of these lights is a blue LED.

Why are cities using blue LEDs? (3)

Nobody actually seems to like the light from these high K (e.g., 5500K) LEDs, but that wasn't a primary concern for many municipalities who were chasing after stimulus money.

Complaints from citizens about the blue glare are now forcing some communities to replace their new, blue LEDs with more expensive low K (e.g. 2700K LEDs). Change over was costly in the short term.

The disturbed natural environment now has to wait around most of these “stimulus money” places...

Need for fully-shielded luminaires.

- Models by Chris Luginbuhl and others were presented by Connie Walker to the CIE in June 2009 as part of an invited review of the effect of LEDs on astronomy – in the context of CIE discussions of this subject.
- Need for more consistent work with the CIE by astronomers to explain the effect of direct lighting above the horizontal. Fully shielded luminaires are needed to protect observatories – particularly if LEDs are used.
- Much work by Chris Baddiley (e.g. IDA annual meeting, Slovenia effort etc.)

Light emitted at low angles.

- Most light emitted vertically escapes from the atmosphere into space without being scattered.
- Light emitted at low angles above the horizontal is a major contribution to light pollution.
- Blue light is scattered much more than red light (λ^{-4} for Rayleigh scattering).
- Models by Baddiley, Luginbuhl etc.



Allies for Astronomy

- Responsible eco-tourism, related to the night-time environment, is taking off in various parts of the world.
- The meeting of experts in Fuerteventura in 2009 suggested exploring the feasibility of including the Starlight Reserve concept in MAB urban ecology and World Heritage cities programmes.
- These initiatives included a {possible} approach to the World Heritage Cities Organization at UNESCO.




Photos of World Heritage Sites from Space

- We are following up lines of enquiry to get night-time images from orbit .
- These can include communities nearest critical sites such as National Parks, Class A observatory sites, Easter Island, Stonehenge and so on.

Scientists handover to governments.

- Extended Case Studies are in many ways the last steps that scientists can take alone in the UNESCO World Heritage process.
- Governments have to decide which areas are of greatest concern to protect - and propose these to UNESCO for consideration as World Heritage sites.
- ***The IAU cannot advance much further along this road unless it gains support from interested governments...***



END

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