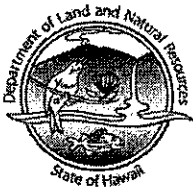


NEIL ABERCROMBIE
GOVERNOR OF HAWAII



**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

**Testimony of
WILLIAM J. AILA, JR.
Chairperson**

**Before the House Committee on
ENERGY & ENVIRONMENTAL PROTECTION**

**Tuesday, March 22, 2011
9:00 AM**

State Capitol, Conference Room 325

**In consideration of
SENATE BILL 1493, SENATE DRAFT 1, HOUSE DRAFT 1
RELATING TO LIGHT POLLUTION**

Senate Bill 1493, Senate Draft 1, House Draft 1 proposes to require the use of shielded lights for all new outdoor lighting fixtures, including those for government agencies. While the Department of Land and Natural Resources (Department) supports the intent of this bill and its future implementation, the Department nonetheless defers to affected parties to further identify potential difficulties, if any, in its implementation and discuss appropriate modifications to reduce unintended and avoidable impacts on operations and safety.

The use of artificial lighting serves the essential purpose of providing safety and security, and facilitates many of the routine activities of society. However, artificial lighting also affects biological and cultural resources by impacting wildlife populations and interfering with night sky viewing. The excessive use of artificial lights also contributes to wasted consumption of energy resources and exacerbates global climate change.

Adoption of this measure is an important step to reduce the negative impacts of artificial lighting on cultural and natural resources. This legislation is one of the initial recommendations of the Starlight Reserve Advisory Committee, which was established by Act 161 of the 2009 Legislature to examine issues related to artificial lighting and recommend workable solutions to reduce the negative impacts of lighting on natural resources and related activities.

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

March 22, 2011

TESTIMONY OF THE DEPARTMENT OF TRANSPORTATION
SENATE BILL NO. 1493, SD1, HD1
COMMITTEE ON ENERGY AND ENVIRONMENTAL PROTECTION

The Department of Transportation opposes the bill.

The Department, as it testified earlier before other House Committees, has already taken steps, over the past years, to provide the higher or more stringent lighting fixtures in counties within the State but those efforts were accomplished under a systematic and planned program of projects.

The Department's actions demonstrate our effort to address the intent of this bill. However, as proposed, we have several concerns and reservations with this bill.

The Department's effort to implement new lighting projects and change outs through maintenance or repairs need to be done in a coordinated and consistent program that is systematically planned and budgeted, especially due to the limited resources and funding currently facing the Department.

Implementation will require coordination with the scientific and environmental parties to properly address our lighting needs and to ensure that energy waste, light trespass, visual confusion, sky glow, etc. are considered so as not to adversely impact the need for dark night sky in areas such as astronomy or the protection of endangered species in Hawaii. These considerations must be balanced with the need to maintain and ensure transportation safety and security, for which the DOT is responsible through its Airports, Highways and Harbors Divisions

The bill's effective date also imposes an unreasonable timeframe to achieve compliance for our divisions to meet the requirements of the bill. Additional time is needed to effectively coordinate, plan, program and, most importantly, obtain the funding for implementation of the lighting.

Our Department has been a participant in the Starlight Reserve Committee and continuation of this Committee to allow further dialog among all affected parties and agencies and provide inter-agency coordination to develop a night sky strategy is critical.

Name

Letter Number

Date

Page

The Department of Transportation stands ready to continue its participatory work with the Starlight Reserve Committee and is committed to work to address dark night sky conditions as well as enable our modal divisions to provide for the lighting needs of the traveling public.

SB 1493

NEIL ABERCROMBIE
GOVERNOR



BRUCE A. COPPA
Comptroller

RYAN OKAHARA
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING
AND GENERAL SERVICES
P.O. BOX 119
HONOLULU, HAWAII 96810-0119

WRITTEN TESTIMONY
OF
BRUCE A. COPPA, COMPTROLLER
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
TO THE
HOUSE COMMITTEE
ON
ENERGY AND ENVIRONMENTAL PROTECTION
ON
March 22, 2011

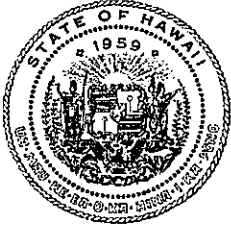
S.B. 1493, S.D. 1, H.D. 1

RELATING TO LIGHT POLLUTION

Chair Coffman and members of the Committee, thank you for the opportunity to testify on S.B. 1493, S.D.1, H.D. 1.

The Department of Accounting and General Services (DAGS) opposes S.B. 1493, S.D. 1, H.D. 1, and defers to testimony provided by the Department of Business, Economic Development and Tourism and Dr. Richard Wainscoat, chair of the Starlight Reserve Committee.

Thank you for the opportunity to testify on this matter.



SB1493

NEIL ABERCROMBIE
GOVERNOR

RICHARD C. LIM
DIRECTOR

**DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM**

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Statement of
RICHARD C. LIM
Director

Department of Business, Economic Development & Tourism
before the
HOUSE COMMITTEE ON ENERGY & ENVIRONMENTAL PROTECTION

Tuesday, March 22, 2011

9:00 a.m.

State Capitol, Conference Room 325

in consideration of
SB 1493 SD1, HD1
RELATING TO LIGHT POLLUTION.

Chair Coffman and members of the Committee. The department supports the intent of SB 1493 SD1, HD1 to minimize glare and light pollution in Hawaii's night skies.

Our department convened a Starlight Reserve Committee in July of 2010 to study the impacts of nighttime light pollution statewide and provide recommendations for a Starlight Reserve Strategy that would address these issues. The chairman of this committee, Dr. Richard Wainscoat, is providing testimony today on this measure.

In addition, we would request that care be taken to ensure that this bill does not weaken existing county ordinances that mandate full shielding of outdoor lighting and maintains those sections that insert language to provide an exemption for outdoor athletic lighting, such as lighting at ballparks, under certain conditions; inserting language to provide an exemption for night-time film production activity; and deferring the implementation of this measure to July 1, 2013.

Thank you for the opportunity to testify on this bill.



UNIVERSITY OF HAWAII SYSTEM

Legislative Testimony

Written Testimony Presented Before the
House Committee on Energy and Environmental Protection
Tuesday, March 22, 2011 at 9:00 a.m.

by
Virginia S. Hinshaw, Chancellor
and
Robert McLaren, Astronomer
Institute for Astronomy
University of Hawai'i at Mānoa

SB 1493 SD1 HD1 RELATING TO LIGHT POLLUTION

Chair Coffman and members of the Committee. My name is Robert McLaren and I am here today to submit this testimony on behalf of the University of Hawai'i. The University of Hawai'i strongly supports this bill that will require full shielding of new and replacement bright lights in Hawai'i.

Mauna Kea on the island of Hawai'i, and Haleakala on the island of Maui, are two of the best astronomy sites in the world. Dark night skies are essential for these observatories to continue to operate. However, increasing urban lighting is threatening the dark night skies over these observatories. Light pollution extends well beyond county boundaries; lights from O'ahu have a major and growing impact on Haleakala, and also affect Mauna Kea. Statewide legislation is needed to protect the observatories.

Astronomy in Hawai'i has a major economic impact. The present economic impact of astronomy is estimated to be \$150 to \$200 million per year.

Full shielding of lights is one of the most important techniques for protecting astronomical observatories from light pollution. Light emitted from poorly shielded fixtures at small angles above the horizontal travels enormous distances through the atmosphere, and is a major contributor to light pollution — it increases sky glow at remote locations, making it difficult or impossible to see faint objects. Fully shielded light fixtures emit no light above the horizontal, and therefore have much less impact on remote locations.

Full shielding also reduces glare, which is a very important safety factor, particularly for older drivers, and greatly reduces the impact of nighttime lighting on species that are affected by light at night, including endangered birds and turtles. Fully shielded lights also deliver more light to the area being lit, producing higher average illuminance per Watt of energy used, and allowing the possible selection of lower Wattage fixtures for roadways; thereby reducing energy usage.

We believe that use of fully shielded lighting will result in only very minimal additional costs for the state for roadway lighting. The State Department of Transportation has recently installed fully shielded lighting in the new highway lighting on H-1 near the Pearl City exit, on H-1 at the new exit in Kapolei, and on Kalanianaʻole Highway near Olomana Golf Course. Fully shielded lights are also being used at other locations on highways and city roads, including numerous locations where it is intermixed with partially shielded lighting. The City and County of Honolulu now uses fully shielded lighting in all new street lighting.

Fully shielded lighting was adopted many years ago for lighting of highways in California, Arizona and Texas.

We have evaluated roadway lighting uniformity from fully shielded lights using the AGI32 roadway lighting software. For any new roadway lighting, we find that satisfactory uniformity of roadway lighting can be achieved using pole spacing that is typical of current installations, and slightly higher mounting height for the light. This means that use of fully shielded lights does not require additional light poles, and therefore the only additional cost would be for slightly taller light poles (which would increase cost by a fraction of a percent of the total cost of a new roadway). We also find that the fully shielded lights result in higher illuminance levels on the roadway for the same Wattage lamps. Fully shielded light fixtures are more efficient because the prismatic lenses in partially shielded fixtures absorb substantial amounts of light. The roadway lighting software shows that use of fully shielded lights in some cases can allow lower Wattage fixtures to be selected (for example 200 Watts instead of 250 Watts), reducing energy usage and therefore reducing operating costs.

In order to eliminate the possibility of any cost for existing roadway lighting from this legislation, the University proposes the following exemption for roadway lighting related to uniformity of lighting with existing pole spacing:

Replacement lighting for roadways and highways shall be fully shielded unless a registered electrical engineer certifies that fully shielded lighting with the existing pole spacing cannot achieve the lighting uniformity levels recommended by the Illuminating Engineering Society of North America. Where fully shielded fixtures are not used, acceptable luminaires shall be partially shielded lights that emit no more than 5% of their light above the horizontal.

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU

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PETER S. CARLISLE
MAYOR

COLLINS D. LAM, P.E.
DIRECTOR

LORI M. K. KAHIKINA, P.E.
DEPUTY DIRECTOR



March 21, 2011

The Honorable Denny Coffman, Chair
and Members
Committee on Energy and Environmental Protection
State Capitol
Honolulu, Hawaii 96813

Dear Chair Coffman and Members:

Subject: Senate Bill No. 1493 SD1, HD1, Relating to Light Pollution

The Department of Design and Construction (DDC) supports the intent of SB1493 SD1, HD1; however, we have concerns regarding the omission of specific exceptions that would make implementation of the bill impractical. Therefore, DDC respectfully requests the following revisions to the bill to improve the practicality of implementation and the clarity of terminology in the bill.

1. The requirements for acceptable luminaries for athletic facilities where "fully shielded" fixtures are not used should be deleted and replaced with the requirement that acceptable luminaries shall include those that can provide the required illumination as determined by a registered electrical engineer, while minimizing light directed above the horizontal plane and off-site light trespass. The specific criteria presented in the proposed new section of Hawaii Revised Statutes, Chapter 201- (b) (1) and (2) would be too limiting for some applications, as athletic facility lighting requirements vary considerably. For example, in a baseball park, "pop flies" can go higher than the light poles, and with the proposed light fixtures the ball could disappear into the night sky before falling at high speed back to the ground.
2. We recommend the term "fully shielded" be revised to "full-cutoff" for consistency with the terminology defined in the Illumination Engineering Society of North America (IES) illumination standards, which are used by the City & County of Honolulu (excerpt enclosed).
3. The proposed terminology requiring every new and replacement outdoor light fixture to be "fully shielded" (full-cutoff) needs to be qualified to indicate that the fixture used shall be able to provide the illumination required for the application. In some

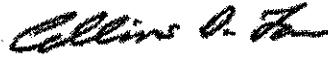
The Honorable Denny Coffman, Chair
and Members
Committee on Energy and Environmental Protection
Page 2
March 21, 2011

applications full-cutoff light fixtures may not be available to provide the illumination requirements. In these applications non-complying fixtures need to be allowed.

4. A qualification to replacement of outdoor light fixtures with "fully shielded" (full-cutoff) fixtures is needed to specify that an inoperable lighting fixture shall be replaced with a full-cutoff lighting fixture that provides equal or better illumination and uniformity as recommended by the IES. If such fixture is not available for the existing light pole spacing, a non-complying fixture that meets the IES illumination and uniformity design criteria shall be allowed. At some locations, full-cutoff light fixtures may not be capable of providing the IES-standard of illumination with the existing light pole spacing. Replacement of existing light poles with more closely spaced light poles in order to satisfy both the illumination and shielding requirements due to a single inoperable fixture would be impractical and prohibitively expensive.

Thank you for the opportunity to testify.

Very truly yours,



Collins Lam, P.E.
Director

CDL:WB:hm

Enclosure



THE
ILLUMINATING
ENGINEERING SOCIETY



Roadway Lighting

RP-8-00
Reaffirmed
2005

Upward light from a luminaire or lighting system must be evaluated. Such light generally adds to sky glow and wastes energy. Unless it is desirable in an urban area, it should be minimized.

2.4.2 Luminaire Cutoff Classifications. Luminaire distribution (see Figure 1) is described by the following terms:

Full Cutoff: A luminaire light distribution where zero candela intensity occurs at or above an angle of 90° above nadir. Additionally the candela per 1000 lamp lumens does not numerically

exceed 100 (10 percent) at or above a vertical angle of 80° above nadir. This applies to all lateral angles around the luminaire.

Cutoff: A luminaire light distribution where the candela per 1000 lamp lumens does not numerically exceed 25 (2.5 percent) at or above an angle of 90° above nadir, and 100 (10 percent) at or above a vertical angle 80° above nadir. This applies to all lateral angles around the luminaire.

Semicutoff: A luminaire light distribution where the candela per 1000 lamp lumens does not

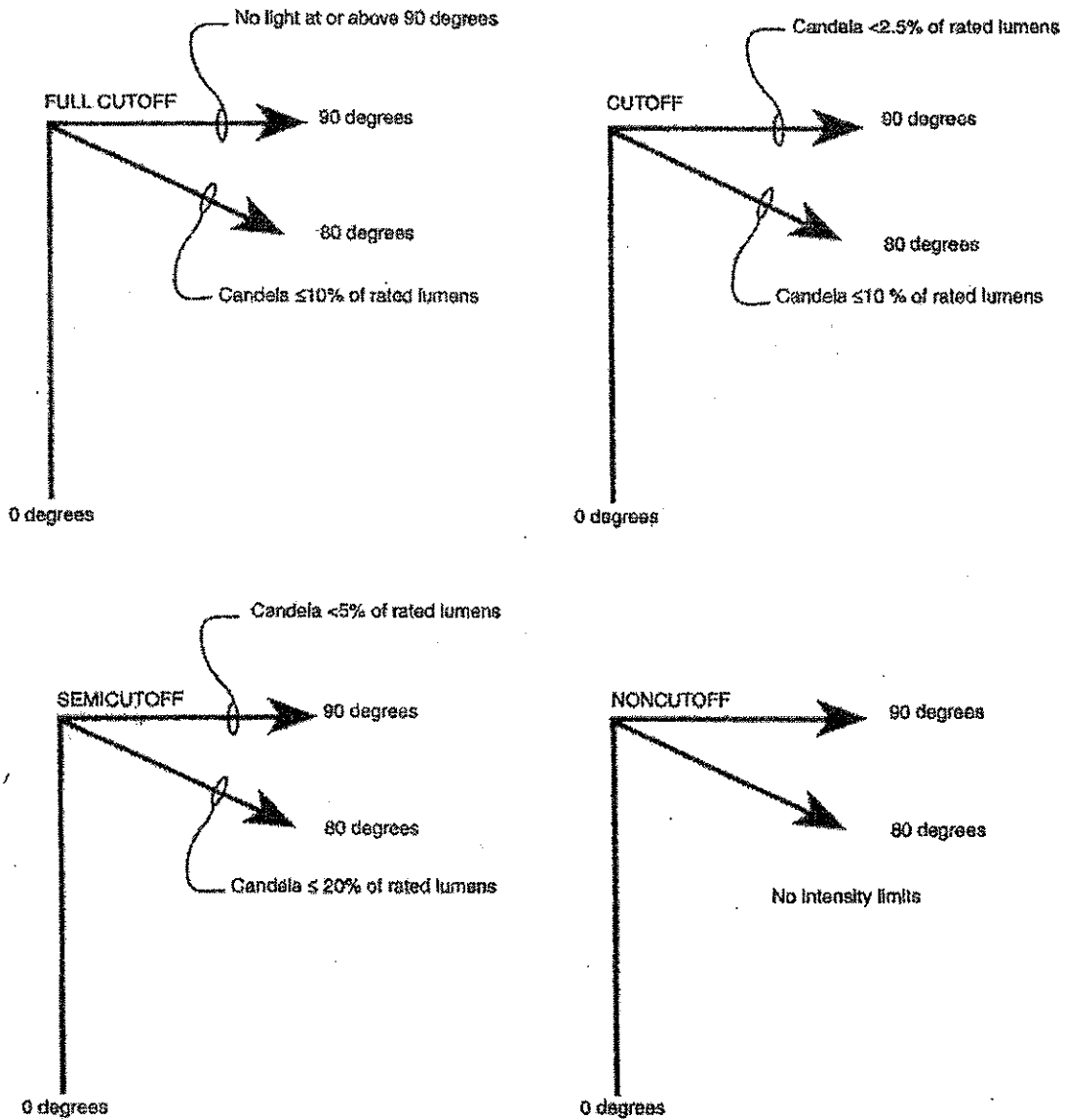


Figure 1. Four different cutoff classifications.

numerically exceed 50 (5 percent) at or above an angle of 90° above nadir, and 200 (20 percent) at or above a vertical angle 80° above nadir. This applies to all lateral angles around the luminaire.

Noncutoff: A luminaire light distribution where there is no candela limitation in the zone above maximum candela.

3.0 DESIGN CRITERIA

This Standard Practice includes three different criteria for use in continuous roadway lighting design. These are illuminance, luminance, and STV. The designer should be familiar with all of these criteria in order to decide which one best addresses the needs of the particular project. Calculation procedures and additional information about these methods are included in the Annexes. Consideration should also be given to glare and sky-glow issues stated in Section 4.6. For issues about light trespass see IESNA TM-10, *IESNA Technical Memorandum Addressing Obtrusive Light (Urban Sky Glow and Light Trespass) in Conjunction with Roadway Lighting*.

The recommended design values, as well as the uniformity ratios as shown in Tables 2, 3, and 4, represent the lowest maintained values for the kinds of roadways and walkways in various areas. Numerous installations have been made at higher values. Furthermore, the design values can be made using different combinations of luminaire light distribution, lamp sizes, mounting heights, spacings, and transverse locations. These figures do not represent *initial* readings, but the lowest *in-service* values of systems designed with the proper light loss factor. When design values for continuous roadway lighting vary due to changes in the road or area classification no special transitions are necessary.

This document follows the guidelines of IESNA LM-67-94, *Calculation Procedures and Specification of Criteria for Lighting Calculations*.

3.1 Illuminance Criteria

The illuminance method of roadway lighting design determines the amount of light incident on the roadway surface from the roadway lighting system. Because the amount of light seen by the driver is the portion that reflects from the pavement towards the driver, and because different pavements exhibit varied reflectance characteristics, different illuminance levels are needed for each type. The illuminance criteria gives recommendations for average maintained lux for various road and area classifications depending on the pavement

type used. The recommended illuminance values and the uniformity ratio are in Table 2. Veiling Luminance Ratios, derived from the luminance calculation method, must also be determined to avoid a lighting system that produces disability glare. (See Table 2.)

3.2 Luminance Criteria

The luminance method of roadway lighting design determines how "bright" the road is by determining the amount of light reflected from the pavement in the direction of the driver. The luminance criteria is stated in terms of pavement luminance, luminance uniformity, and disability veiling glare produced by the lighting system. Table 3 provides the recommended luminance design requirements, uniformity and the relationship between average luminance (L_{avg}) and the veiling luminance (L_v).

3.3 Small Target Visibility (STV) Criteria

The STV method of design determines the visibility level of an array of targets on the roadway considering the following factors:

- (a) The luminance of the targets
- (b) The luminance of the immediate background
- (c) The adaptation level of the adjacent surroundings
- (d) The disability glare

The weighted average of the visibility level of these targets results in the STV. The values of STV are included in Table 4 as well as uniformity ratios and luminance requirements for mitigating the effect on approaching headlights. The veiling luminance ratio component is included in the STV calculation methodology.

3.4 High Mast Lighting

Ordinarily, conventional lighting along streets and highways involve mounting heights of 15 meters (49.2 ft.) or less. Poles of 20 meters (65.6 ft.) or greater height have been utilized in several situations:

- Large parking lots - such as regional shopping centers, and stadiums
- Interchanges and complex intersections in both urban and rural areas and tangent sections with more than six lanes

Opinions differ on whether light levels can be lower when high mast lighting is used, compared with the use of conventional poles of 15 meters (49.2 ft.) or less. Typically, the surround conditions are more uniform with the high mast design and, seeing is easier. Prior editions of ANSI/IESNA RP-8 have allowed lower



International Dark-Sky Association

"...to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting."

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21 March 2011

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Debra Norvil • USA
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Reginald Wilson • Australia

To Whom it Concerns:

The International Dark-Sky Association asserts its strong support for Hawaii S.B. 1493: A Bill for an Act Relating to Light Pollution. The State of Hawaii is custodian to one of the most pristine astronomical viewing locations in the world and the Hawaiian archipelago supports unique or endangered species found nowhere else on earth. Both conditions are directly affected by the use of excessive artificial light at night. The establishment of legislation to shield outdoor private and commercial outdoor lighting fixtures and direct light below the horizontal plane is vital to protecting Hawaii's dark night skies and the undeniable cultural, economic, and environmental benefits associated with them.

The International Dark-Sky Association is a 501 (c)(3) non-profit organization based in Tucson, Arizona and was founded in 1989 to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting. Considered the foremost authority on light pollution in the United States, IDA works with leading astronomers, ecologists, lighting designers, and energy experts across the globe to assess and distribute the most current information on ways to control and reduce excess outdoor light at night. IDA shares information with the U.S. National Parks Service, the U.S. Congress, the U.S. Department of Energy, and works with numerous local and state governments to create legislation that will save energy, reduce impact to nocturnal species, and protect the dark night sky for scientific and cultural pursuits. Studies and empirical data (Neugent, Kathryn; Philip Massey, "The Spectrum of the Night Sky Over Kitt Peak: Changes Over Two Decades," Proceedings of the Astronomical Society of the Pacific, October 2010) show that enforceable lighting ordinances allowing no light to escape above the horizontal plane are effective in reducing sky glow, controlling excess and inappropriate light at night, and maintaining the astronomical integrity of a site.

Please consider the following arguments in favor of the proposed legislation as you make your decision. Note that the subheads Astronomy, Energy, and Environment were submitted on 18 February 2011. The information on Roadway Lighting Considerations and Precedent are submitted for the first time in this missive.

Respectfully,

Bob Parks
Executive Director

IDA Offices

Washington, DC, USA | Hever, Belgium | Turrumurra, New South Wales, Australia

Astronomy:

Astronomy in Hawaii generates between \$150 to \$200 million annually. Its economic value alone provides reason enough to protect this industry with S.B. 1493. However, the true value of astronomy as a revenue source exceeds numerical calculations.

Where tourism and agriculture can degrade the state's delicate environment, astronomy provides a truly sustainable source of revenue. It is also an industry based on the pursuit of information and supported by a highly technical sub-industry, exactly like the type of industry declared necessary to move the United States forward into the age of technology by President Obama in his 2011 State of the Union address.

The Mauna Kea summit houses the world's largest astronomical observatory. The quality of observatory sites is determined by a number of factors, including atmospheric stability, air quality, and darkness. Around the world, only a handful of sites meet these criteria; yet Mauna Kea offers these conditions and a temperate environment that allows viewing throughout the year. It is one of a kind. Its thirteen telescopes operated by eleven countries create a cultural and scientific hub. The observatory attracts international investment and promotes international cooperation.

In addition, "Astrotourism" to truly dark sites is gaining popularity as skies all over the world are affected by uncontrolled artificial lighting. Astronomical pursuits are already an important component of Hawaiian tourism; the 'Imiloa and the Mauna Kea Visitor Center very popular attractions. The travel guide *Hawai'i: The Big Island* by Luck Yamamoto and Alan Tarbell, (pub Lonely Planet 2005) predicted that the popularity of 'Imiloa (then known as the Mauna Kea Astronomy Education Center) as a Big Island tourist destination would be exceeded only by Volcanoes National Park.

These benefits are jeopardized by increasing sky glow among the islands. Figure 1 below depicts the visibility of city light from other Hawaiian islands.

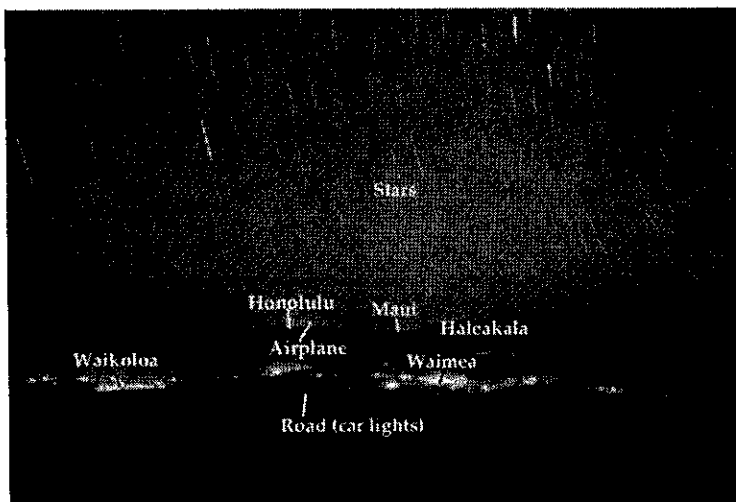


Figure 1 (Photo credit: R. Wainscoat)

Energy:

Hawaii's remote location has fostered innovative methods of energy generation, including geothermal, solar, and wind power. However, there is no substitute for reducing power consumption where possible. Design of shielded outdoor fixtures promotes technology that directs light more efficiently, lowering total energy output in a fixture and decreasing total energy consumption.

Environment:

While numerous factors including light pollution threaten Hawaiian wildlife, stray light at night is a direct source of population decline in marine birds.

Marine birds are particularly sensitive to artificial light, perhaps because many are nocturnal and are attracted to the bioluminescence of some prey species. Documented cases of resort lighting in Hawaii attracting, exhausting, and ultimately killing coastal and pelagic birds occur every year, usually upon a young bird leaving the nest on its first journey to the ocean. Many of these species are endangered or threatened, including the beloved Newell's Shearwater. In 1998, volunteers rescued 819 exhausted and disoriented young Shearwaters around resorts on the island of Kauai.¹

Besides being a celebrated tourist attraction, Hawaii's particular fauna is fundamental to the islands' cultural identity. The outdoor lighting policies proposed in S.B. 1493 will help protect the welfare of this iconic species.

Roadway Lighting Considerations and Precedent:

While the requirement for fully shielded roadway lighting fixtures may induce additional costs above those lighting systems using partially shielded luminaires for continuously lighted new roadways or highways, the incremental costs for same are but a fraction of total new roadway project construction costs. Said costs have been deemed as an acceptable offsetting investment to protect astronomical and/or environmental resources and their associated economic benefits in other locales, including but not limited to the states of Arizona, California and Texas. The use of somewhat taller poles and a palette of mast arm designs has been implemented over the last 25 years by the Department of Transportation in the city of Tucson, Arizona to economically accommodate the exclusive use of fully shielded roadway lighting systems throughout the region. A photo of a newer segment of North Stone Avenue (Image A) is attached for reference. The lighting fixtures shown are standardized throughout the metropolitan area.

If initial costs and recurring energy charges are of paramount importance, consideration should be given to providing only 'conflict point' lighting in lieu of continuous roadway lighting systems as is standard practice for highways throughout California. This strategy is also used in many other locales.

Retrofitting of existing partially shielded luminaires with new fully shielded fixtures as the older products reach end of useful life has numerous precedents in mainland jurisdictions. In some cases, existing pole heights and spacings allow direct replacements while still maintaining IESNA recommend uniformity ratios. A photo of an older section of North Stone Avenue in Tucson, Arizona (Image B) is attached to demonstrate modern fully shielded luminaires that have been installed on vintage 1970's poles with scribed masts.

¹ Montevecchi, William "Influences of Artificial Light on Marine Birds," *Ecological Consequences of Artificial Night Lighting*, ed. Catherine Rich, Travis Longcore, Island Press, 2006.

Where existing pole spacings are deemed to be inadequate to allow for straightforward replacement of partially shielded luminaires with fully shielded luminaires, a short structural pole extension may be utilized to economically achieve the required space-to-mounting ratios for proper uniformity ratios in lieu of physically changing the pole spacings at great cost. A photo of south Alvernon Way in Tucson, Arizona (Image C) is attached to document the application of this practice.

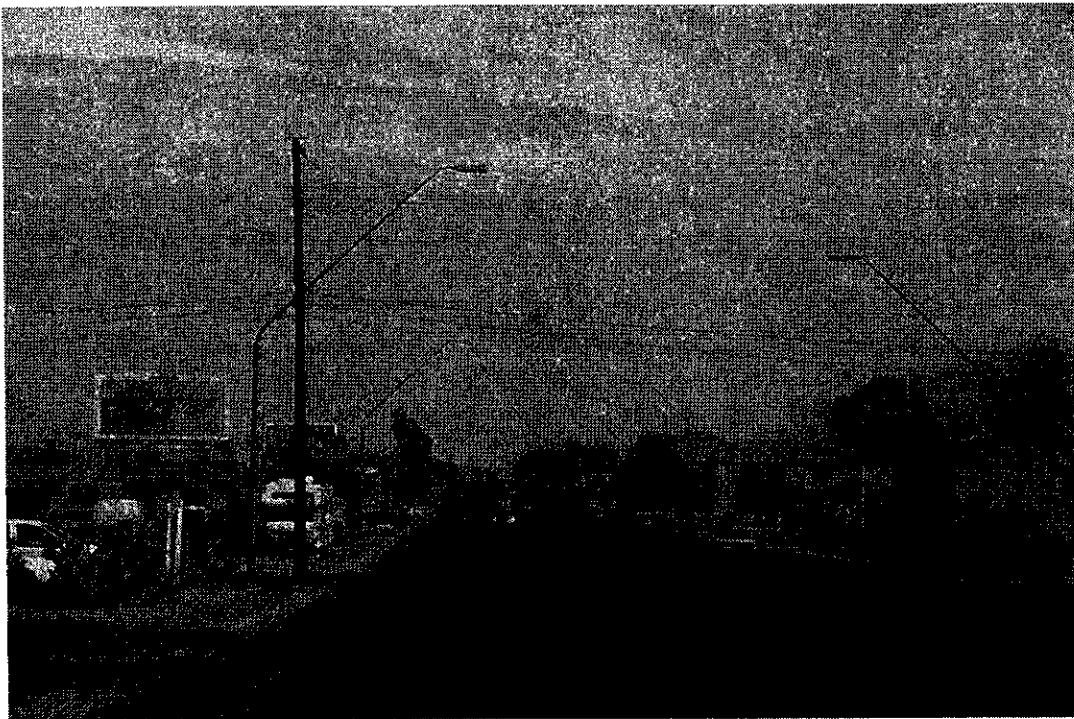
In order to assure competent technical guidance and alignment with the lighting needs of end users and the public at large, the Board of Directors of the international Dark Sky Association has in the past and continues to contain members of various IESNA, CIE and Standards Australia committees, including the IESNA Roadway Lighting Committee. The IDA Board also included traffic engineers from the City of Los Angeles and the City of Tucson for several years. Accordingly, we believe that the strategies described above are worthy of serious consideration.

Conclusion:

The remote Pacific Island location of the Hawaiian archipelago ensures that no external development will threaten the pristine darkness of this site. All light pollution within the islands is generated within Hawaii. This fact makes Hawaii's light pollution relatively easy to control but reinforces the imperative of creating a means to do it. City light can be visible up to 200 miles away, so light generated on one island can easily affect another. S.B. 1493 provides the means of uniformly controlling light pollution in a reasonable manner and providing statewide protection for its precious night sky resources.

Images:

Image A



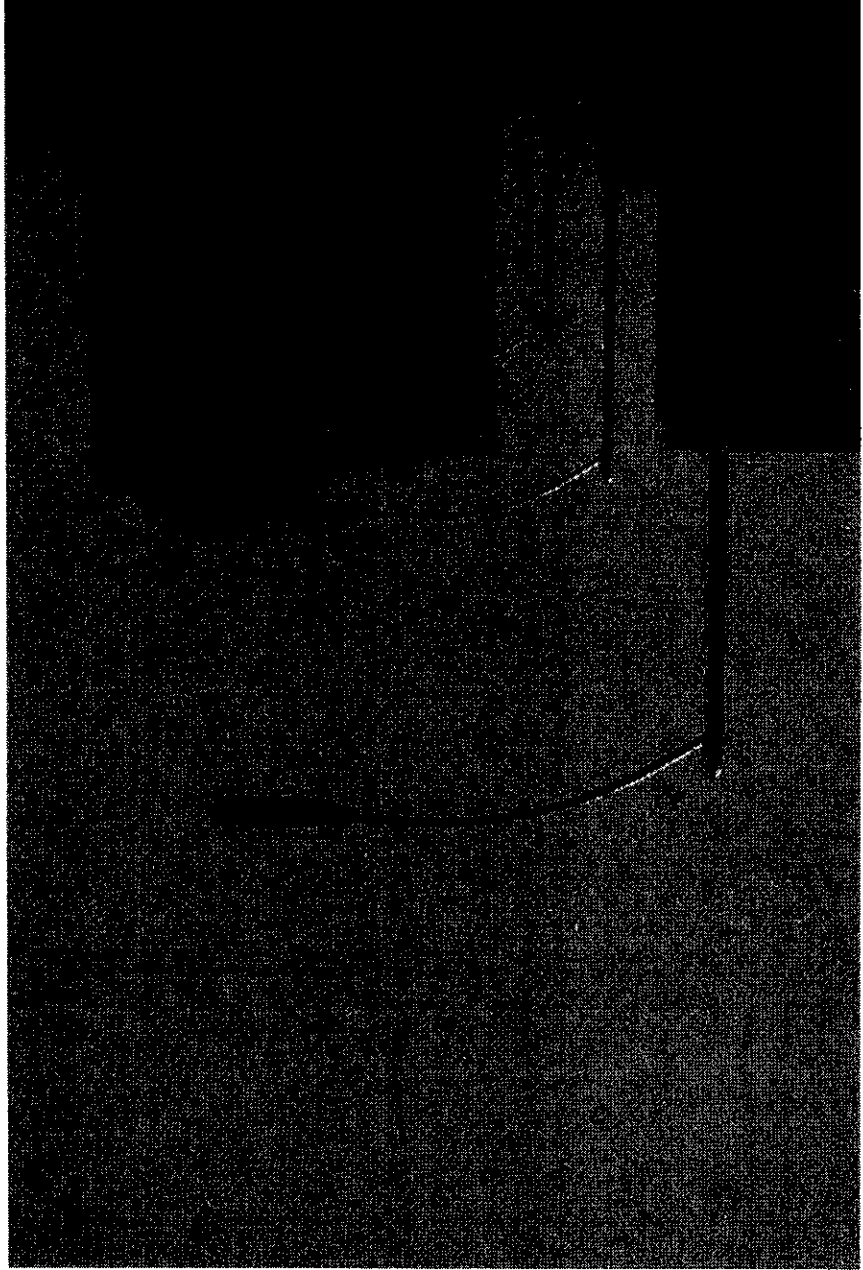


Image B

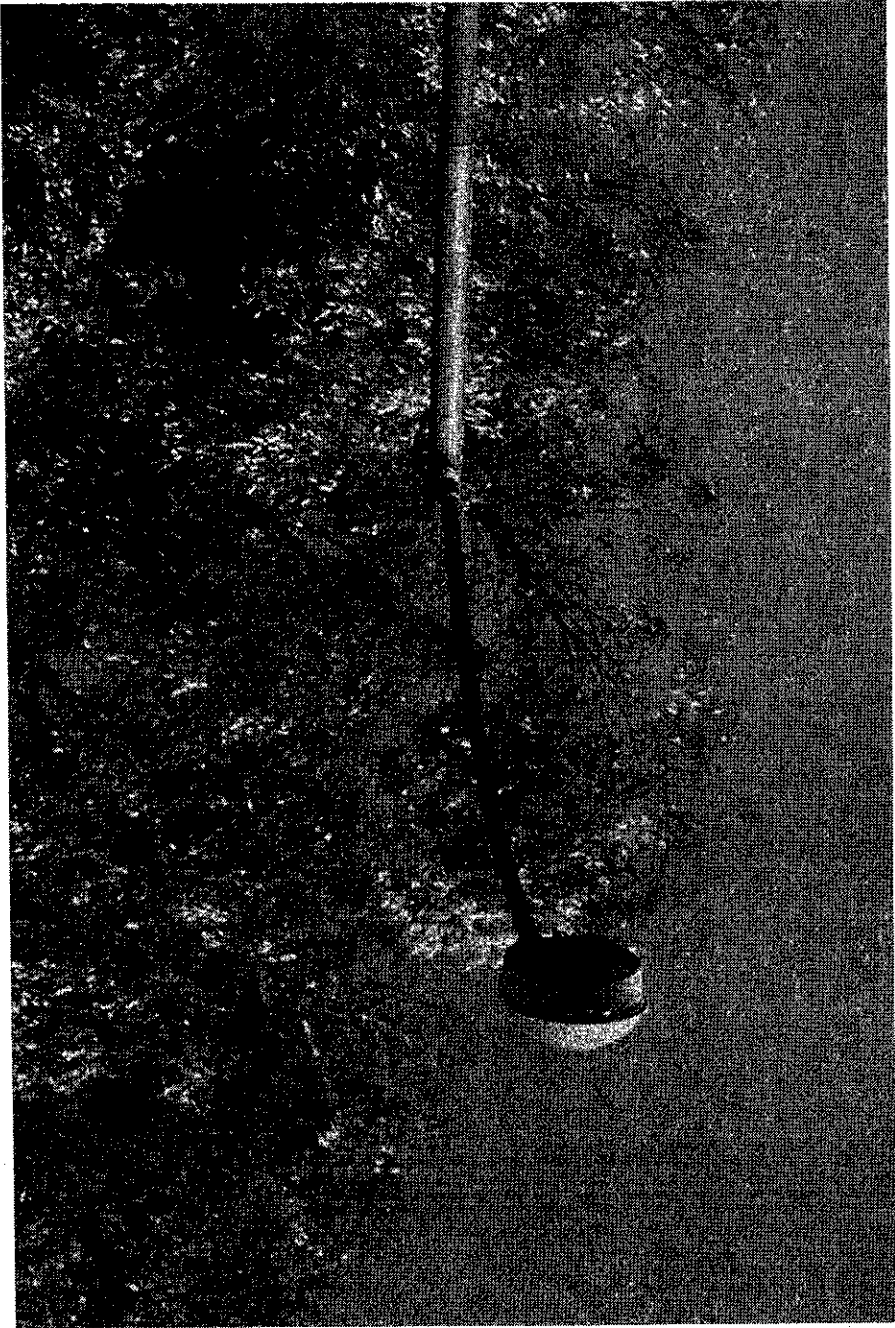


Image C



Sierra Club Hawai'i Chapter

PO Box 2577, Honolulu, HI 96803
808.538.6616 hawaii.chapter@sierraclub.org

HOUSE COMMITTEE ON ENERGY & ENVIRONMENTAL PROTECTION

March 22, 2011, 9:00 A.M.

(Testimony is 1 page long)

TESTIMONY IN SUPPORT OF SB 1493, SD1, HD1

Aloha Chair Coffman and Members of the Committee:

The Hawai'i Chapter of the Sierra Club, with 8,000 dues-paying members and supporters, **supports** SB 1493, SD1, HD1. This measure requires most new lighting fixtures to be fully shielded.

Reducing unnecessary light pollution will have a definitive environmental benefit. Artificial lighting can adversely impact the nesting and feeding behaviors of birds and marine life.

Every year, thousands of baby birds (fledglings) leave their nests for their first flight to the ocean. Many of them are disoriented by bright night-time coastal lights, often scenic ocean spotlights in residential coastal communities but also airport and facility lights. After flying to exhaustion (or collision) and falling to the ground, exhausted fledglings are extremely susceptible to predation.

Adult seabirds, including the endangered Hawaiian petrel (*Pterodroma sandwichensis*) and the threatened Newell's shearwater (*Puffinus auricularis newelli*), also suffer the negative impacts of artificial night lighting. The wedge-tailed shearwater (*Puffinus pacificus*), while not yet listed as threatened or endangered, is protected under the Migratory Bird Treaty Act and adversely impacted by artificial night lighting. These protected seabirds are found in many areas throughout the State and transit coastal areas that are fully developed. In addition to protecting Hawaii's native and endangered species, residents and visitors alike share a great appreciation of dark Hawaiian skies for stargazing—and romantic walks along the moonlit beach.

Thank you for the opportunity to testify.

Testimony Related to
Senate Bill 1493 SD1 HD1
RELATING TO LIGHT POLLUTION

Presented before the
House Committee on Energy and Environmental Protection

The Twenty-Sixth Legislature

March 22, 2011

by

Richard J. Wainscoat

Chair, Starlight Reserve Committee

Chair Coffman, and members of the Committee. My name is Richard Wainscoat and I am submitting this testimony in my capacity as Chair of the Starlight Reserve Committee.

The Starlight Reserve Committee was established by the 2009 state legislature. It held its first meeting in July 2010, and has met on four occasions. The committee engaged in much fact finding during these meetings, and found a common factor that proper shielding of nighttime lighting is critically important. During its third meeting, the committee recommended introduction of legislation in the 2011 legislature that would result in shielding of new and replacement bright light sources.

Full shielding of lights has the following important advantages:

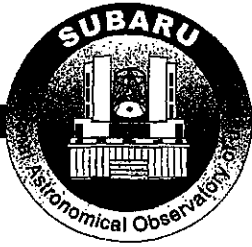
1. Light sources are not visible from above, meaning that the impact on endangered birds that are attracted to lights at night, such as the Newell's shearwater, is much reduced.
2. Fully shielded lights emit little light near the horizontal, so the impact on endangered turtles that become disoriented by lights on beaches is much reduced.
3. Fully shielded lights cause much less glare than partially shielded lights, improving safety, including on our roadways. It is particularly important to avoid glare for elderly drivers, who may have degraded vision due to cataracts or other reasons.
4. Fully shielded lights cause much less skyglow, dramatically reducing the impact of artificial lighting on Hawaii's astronomical observatories. Light emitted at small angles above the horizontal travels enormous distances through Earth's atmosphere. It does not respect county boundaries. Light from Honolulu affects both Haleakala and Mauna Kea Observatories. Use of fully shielded light fixtures is the most important technique for protecting astronomy in Hawaii.

5. Partially shielded lights emit some of their energy directly into space where it is wasted. Fully shielded lights direct their energy downwards only, where it is needed, and can therefore save energy. Fully shielded lights produce higher illuminance on the roadway per Watt of energy used, and higher small target visibility. Use of fully shielded lights allow lower Wattage lamps to be selected in some cases, producing substantial energy savings.
6. Fully shielded lights emit much less light at near horizontal angles, meaning that light trespass is substantially reduced. Light from adjacent properties or from streetlights entering our bedrooms is a form of light trespass. It can make it difficult to sleep at night. Excessive light at night has been linked to some forms of cancer, particularly breast cancer.
7. Use of fully shielded lights across Hawaii will result in a substantial decrease in skyglow, and restore the ability of Hawaii's residents and visitors to see the night sky. The Milky Way is no longer visible from urban Honolulu. Only about the brightest 20 stars are visible from urban Honolulu. About 2,000 stars can be seen from a dark location. The dark night sky on the island of Hawaii is becoming a tourist attraction — many of Hawaii's visitors come from urban locations that have severe light pollution, and are amazed by the view of the dark night sky from the island of Hawaii. Sadly, many of our children are growing up without ever seeing the magnificent night sky. This is unnecessary, and is a direct result of irresponsible and careless use of light at night.

The 3,000 lumen exemption recommended for this legislation is a very generous exemption. It is the equivalent of a 150 Watt halogen lamp. The Starlight Reserve Committee will discuss this exemption in future meetings and may recommend a lower limit in the future. Because lighting is on the verge of a revolution coming from rapid improvements of light emitting diodes, the committee felt that it was important to make a first step at improving lighting this year, and chose the 3,000 lumen exemption in an effort to make the proposed legislation uncontroversial, while yielding meaningful results from good shielding of the brightest new light sources.

The 3,000 lumen exemption means that most residential lighting in Hawaii will be exempt — only very bright outdoor residential lights, such as high intensity discharge lamps, will be affected.

The exemption for recreational lighting specified in the bill will substantially decrease energy usage by recreational lighting by reducing stray light from these facilities. It will also improve the light quality for the athletes at recreational facilities.



Subaru Telescope

National Astronomical Observatory of Japan
650 North A'ohoku Place, Hilo, Hawaii 96720, U.S.A.

March 21, 2011

Dear Chair Denny Coffman, and Energy and Environmental Protection Committee members of the Hawaii State Legislature,

As the director of the Subaru Telescope on Mauna Kea, I would appreciate the opportunity for letting us to submit this testimony in support of SB1493 that would require all new and replacement outdoor light fixtures be fully shielded beginning July 1, 2013.

The Subaru Telescope is fortunate to be allowed the use of the world best site for astronomy, the summit of Mauna Kea, for the best telescope Japan could offer to astronomers worldwide. Since the first light in 1999 Subaru Telescope has been contributing to many discoveries ranging those of the most distant and therefore earliest galaxies humankind observed to those of planets other than of our own Solar System. We are continuing our efforts on Mauna Kea to keep the telescope one of the most sensitive in the world in anticipation for more discoveries to come under the best conditions for astronomical observations. One of the most important environmental considerations is darkness of the sky during night.

The Subaru Telescope also recognizes that one of the challenges today to humankind is global energy consumption. The light illuminating the sky upward is not only the pollution of the sky darkness and detrimental to the most sensitive astronomical instrumentations on Mauna Kea, it is also substantial wasted energy. Being able to eliminate the waste would only lead to the reduction of energy consumption with no harm to anything else.

For these reasons, I would like to submit this testimony in support of the SB1493 wholeheartedly, representing the Subaru Telescope and also the astronomical community that benefits from the Subaru Telescope on Mauna Kea.

Thank you very much.

Yours truly,

Dr. Hideki Takami
Director



W. M. KECK OBSERVATORY
On the summit of Mauna Kea, Island of Hawai'i

TO: Energy and Environmental Protection Committee

FROM: Taft Armandroff, Director, W. M. Keck Observatory

DATE: March 18, 2011

Aloha Chair Denny Coffman and Committee Members,

Thank you for the opportunity to provide testimony in support of SB1493, which would require fully-shielded lights on new and replacement outdoor light fixtures.

The W. M. Keck Observatory operates the world's two largest fully steerable optical / infrared telescopes on the summit of Mauna Kea. Mauna Kea has been clearly demonstrated to be an excellent environment to study our Cosmos using optical astronomy. Many have argued compellingly that Mauna Kea is a unique site on Earth, allowing the clearest views of the Universe with the least interference by our atmosphere and by man-made interference. Astronomers are using Keck Observatory nightly to deepen our understanding of the Cosmos. Topics studied include the origins of stars and planets.

Astronomy is a clean, sustainable, high-tech industry that Hawaii is uniquely suited for. All of the observatories in Hawaii are actively engaged in educational outreach to our schools and communities, promoting STEM (science, technology, engineering and mathematics) learning. The local public has been captivated by the discoveries from Mauna Kea, including the announcement this fall on the front pages of all Hawaii papers announcing the discovery of an earth-like planet beyond our own Solar System that is sufficiently temperate to permit liquid water on its surface.

Light pollution is the prime factor that we can control that impacts astronomy. The shielding measures recommended are highly prudent and are of direct benefit to astronomy. Please preserve this unique resource of our dark Hawaii night sky for astronomical discovery.

Please vote "yes" on this important measure benefitting astronomy and clean industry in Hawaii.

Thank you again for the opportunity to provide testimony.

morita1----Tammy

From: EEPtestimony
Sent: Monday, March 21, 2011 3:12 PM
To: morita1----Tammy; morita1----Tammy
Subject: FW: Testimony for SB1493 on 3/22/2011 9:00:00 AM

From: mailinglist@capitol.hawaii.gov [mailinglist@capitol.hawaii.gov]
Sent: Sunday, March 20, 2011 2:04 PM
To: EEPtestimony
Cc: idasonry@aol.com
Subject: Testimony for SB1493 on 3/22/2011 9:00:00 AM

Testimony for EEP 3/22/2011 9:00:00 AM SB1493

Conference room: 325
Testifier position: support
Testifier will be present: No
Submitted by: Dr. David L Crawford
Organization: Individual
Address:
Phone:
E-mail: idasony@aol.com
Submitted on: 3/20/2011

Comments:

As both a professional astronomer (now retired) and a outdoor lighting consultant, and as a frequent visitor to the islands, I fully support this bill. It discusses the issues remarkably well and the proposed solutions to the problems are very well stated. When enacted, it will help greatly to solve all the issues noted in the bill. It will become a model for other states and affirm Hawaii as a leader in both understanding the issues and proactively doing something effectively and efficiently about them. I congratulate you for these efforts and action.

morita1---Tammy

From: EEPtestimony
Sent: Monday, March 21, 2011 3:08 PM
To: morita1---Tammy
Subject: FW: Testimony for SB1493 on 3/22/2011 9:00:00 AM

From: mailinglist@capitol.hawaii.gov [mailinglist@capitol.hawaii.gov]
Sent: Friday, March 18, 2011 1:34 PM
To: EEPtestimony
Cc: babyjean@hotmail.com
Subject: Testimony for SB1493 on 3/22/2011 9:00:00 AM

Testimony for EEP 3/22/2011 9:00:00 AM SB1493

Conference room: 325
Testifier position: support
Testifier will be present: No
Submitted by: Ronnie Perry
Organization: Individual
Address:
Phone:
E-mail: babyjean@hotmail.com
Submitted on: 3/18/2011

Comments:

We really need this bill as light pollution on Oahu is really bad and is an eyesore.