



UNIVERSITY OF HAWAI'I SYSTEM
Legislative Testimony

Bill No. 536

Support Y N

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Testimony Presented Before the
House Committee on Energy & Environmental Protection and
House Committee on Water, Land, & Ocean Resources
March 24, 2009, at 9:00 a.m.

by
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and
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and
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SB 536 SD1 RELATING TO STARLIGHT RESERVE

Chairs Morita and Ito, Vice-Chairs Coffman and Har, and members of the committees. My name is Richard Wainscoat and I am here today to submit this testimony in my capacity as an Astronomer at the University of Hawai'i Institute for Astronomy, and as President of Commission 50 of the International Astronomical Union, for the protection of existing and potential observatory sites.

The University of Hawai'i at Mānoa strongly supports this bill and recommends that it be passed.

Hawai'i has two of the best astronomical observatory sites in the world. Mauna Kea Observatory on the Island of Hawai'i is arguably the best observing site on Earth. Haleakalā Observatory on Maui is among the best observing sites in the Northern hemisphere. Mauna Kea is threatened by light pollution. Haleakalā already suffers from significant light pollution that comes both from Maui County and from O'ahu.

Much of the populated area of the Earth suffers from unnecessary light pollution. Light pollution is adverse effects of man-made lighting including sky glow, energy waste, glare, and environmental harm. Much of it is unnecessary, and results from careless and wasteful use of light at night. The Island of Hawai'i has had a lighting ordinance for many years, and it has protected the dark night sky over Mauna Kea. However, continued population growth and the associated growth in lighting is threatening the dark night sky over Mauna Kea, and will require more careful choice of lighting in the future. Maui County enacted a new lighting ordinance in 2008 that will help to reduce light pollution over Haleakalā. However, Maui's lighting ordinance will do nothing to reduce the light from O'ahu that is affecting Haleakalā. Kaua'i does not have a lighting ordinance, but already has some of the best lighting in Hawai'i because it has many endangered birds. All streetlights on Kaua'i are fully shielded, and emit no light above the horizontal plane; unshielded lights cause confusion to birds (possibly leading to death).

Light can travel for over 200 miles through the atmosphere (light from Honolulu can be seen from Mauna Kea). Therefore, preservation of the night sky is a statewide issue.

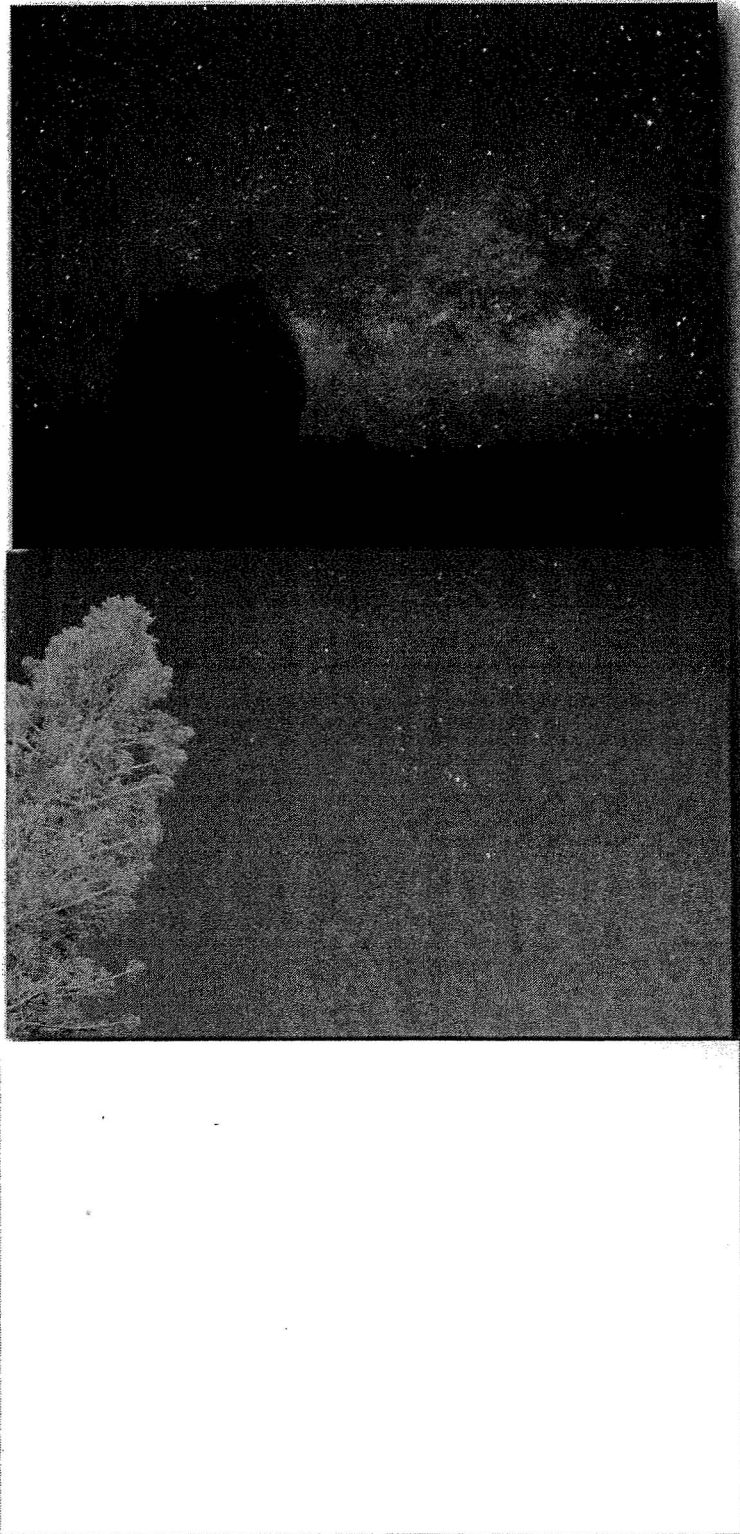
Sky glow is the aspect of light pollution that most affects astronomy. Air molecules and dust scatter artificial light into the telescopes. Every 10% brighter that artificial light makes the sky from its natural level makes the effective size of a telescope 10% smaller. The following series of photographs, using the same exposure, shows the difference in sky brightness and star visibility between Mauna Kea, Kailua (O'ahu), and Honolulu. On O'ahu, the sky at Sandy Beach, where we take our undergraduate astronomy students to view the night sky is about four times brighter than on the Big Island. The Milky Way is barely visible from Sandy Beach. Much of the light that is being sent upwards into the sky is wasted, and therefore corresponds to wasted energy. In Hawai'i, approximately \$10 million is wasted each year by poor lighting.

The "Starlight Reserve" concept is being developed in cooperation with the United Nations Educational, Scientific and Cultural Organization (UNESCO) to address the loss of the ability to view the night sky that is happening across the Earth. Over 99% of the visitors to Hawai'i come from places with significant light pollution. Much of the continental United States has a serious light pollution problem. The night sky is relatively unpolluted on all of the major Hawaiian Islands except O'ahu, and even on O'ahu, the dark night sky could be recovered by more careful use of light at night. The State Department of Transportation is already improving lighting on highways by using fully shielded light fixtures in new installations and when replacing existing fixtures.

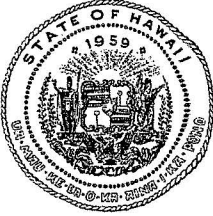
The work of the advisory committee that will be created by this legislation will have tremendous benefits to Hawai'i that extend far beyond protection of astronomy. These include:

1. Energy savings, by reducing or eliminating wasteful use of light at night;
2. Improved road safety by reduction of glare from roadway lighting;
3. Benefits to animals, including endangered birds that become confused by artificial lights at night, and endangered turtles, that use stars to guide them to the water after hatching or nesting, and mistake artificial lights for stars;
4. Preservation and recovery of the ability of Hawai'i's residents and visitors to view the beauty of the night sky; and
5. Benefits to human health. Light at night disrupts the human circadian rhythm, and has been linked to breast and prostate cancer. Because of this link, the World Health Organization has listed shift work as a probable carcinogen.

Thank you for the opportunity to present this testimony.



Photographs of the night sky seen from Mauna Kea (top), Kailua, O'ahu (middle), and Honolulu (bottom), using exactly the same exposure time. Notice the dramatic differences in sky brightness, and how many more stars are visible from Mauna Kea than from O'ahu.



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Statement of
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before the

**HOUSE COMMITTEE ON ENERGY & ENVIRONMENTAL PROTECTION
AND THE
HOUSE COMMITTEE ON WATER, LAND & OCEAN RESOURCES**

Tuesday, March 24, 2009
9:00 a.m.

State Capitol, Conference Room 325

in consideration of
SB 536 SD1
RELATING TO STARLIGHT RESERVE.

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Chairs Morita and Ito, Vice Chairs Coffman and Har, and members of the Committees.

The department supports the concept behind SB536 SD1, which supports the development of a statewide starlight reserve strategy to preserve the quality of Hawaii's night sky and its associated cultural, scientific, natural, and landscape-related values.

We concur that establishing a starlight reserve in Hawaii would help to reduce the amount of ambient light pollution in the night skies over our State. In so doing, we believe this reserve would both protect and promote cultural heritages associated with the night sky, help safeguard the equilibrium of the biosphere in which nocturnal and diurnal habitats are threatened by light pollution, and significantly enhance the quality of our night skies for astronomical

observation and research.

In order to achieve the potential benefits for astronomy, tourism, public health, education, biological diversity, land management, and economic development statewide, we believe that a starlight reserve strategy must be developed and implemented in coordination with appropriate State, County and Municipal agencies and organizations to ensure its quality, efficacy and sustainability. The proposed starlight reserve advisory committee would work with our department to include all stakeholders potentially impacted by the reserve and take into account all pertinent safety regulations.

We understand that the intent of the proponents of the starlight reserve is to reduce the potential financial impact of implementation by proposing the replacement of existing light fixtures, after they degrade/expire, with more energy and cost efficient technology.

Thank you for the opportunity to testify on this bill.

EEPtestimony

From: Jim Crisafulli [JCrifafu@dbedt.hawaii.gov]
Sent: Sunday, March 22, 2009 10:42 AM
To: EEPtestimony
Subject: Background article on light pollution for hearing on SB 536 (Tuesday, March 24, 9:00 a.m. in Room 325)
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Importance: High

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Bill No. 536

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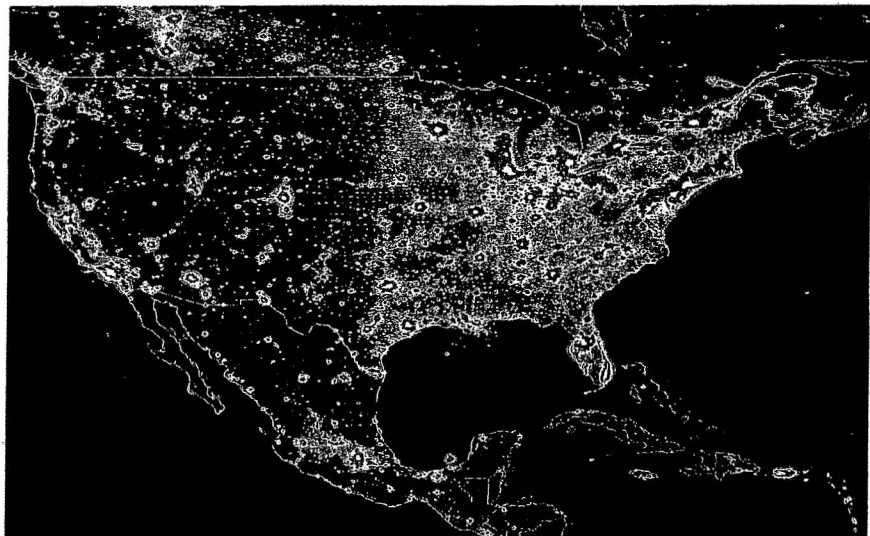
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Army of darkness

Can we win the war against light pollution?

The night sky is getting brighter. Here's how we can reverse the trend. by Michael E. Bakich



Map of light pollution by Michael E. Bakich

Observers, astrophotographers, and nature-lovers all have a common enemy: light pollution. This insidious problem, caused by excess nighttime lighting, is growing worldwide. Satellite images show few regions of our planet's nightside are truly dark. It's possible, in fact, that the Moon is the only object young people in large cities will ever see. Indeed, the dark night sky is an endangered natural resource.

Nobody denies that some outdoor lighting is necessary for people's safety

Michael E. Bakich is a senior editor of Astronomy.

and security. Other lighting, such as that used for advertising, may not be necessary, but it's a consequence of living in our world today. If those lights are designed and maintained correctly, they can be a benefit without taking away from the night sky's beauty.

Defining the problem
Outdoor light pollution manifests itself in three ways: light trespass, glare, and clutter. Light trespass occurs when unwanted external light enters your property. It can ruin an imaging session or cause sleep deprivation if bright light enters through a bedroom window.

This color-coded map of light pollution across the United States shows the darkest areas as black. These areas generally are remote. Gray and mauve regions are ideal hunting grounds for pristine skies. Often, these areas are rural and are not accessible by road. Green sections have acceptable dark-sky conditions. If you don't have access to any of the black areas (as will be the case in many of the northeastern states), go for the green.

Glare results from high contrast between lit and unlit areas. Although it affects amateur astronomers, it's most often a problem for drivers. Bright streetlights, advertising signs, and poorly placed lights used by businesses are the primary causes of glare.



Bad lighting in El Paso, Texas — and many other cities — has multiplied in recent years. If not for the mountains in the background, these lights might have gone on farther. Michael E. Bakich

Clutter refers to badly designed or excessive light groups that generate confusion or cause safety issues. This generally affects automobile drivers.

The light stops here
The best outdoor lighting falls under the classification "full-cutoff." Full-cutoff fixtures do not allow light to escape above 90°, which marks the edge of the lamp's shade. Such fixtures distribute light in a directed pattern and provide equivalent ground lighting with less power. The first full-cutoff light fixture was General Electric's M100, introduced in 1959.

Many states mandate full-cutoff lights for building or highway construction. Today's full-cutoff fixtures generally employ high-pressure sodium lamps. Introduced in 1970, they are the dominant streetlights in the United States. The main characteristic is their orange-yellow



Earth at night gets less dark every year. As this image shows, the worst offenders are the United States and Europe. Data courtesy Macbeth of NASA GSFC and Christopher Eléaga of NOAA MDC. Image by Craig Mayhew and Robert Simmon, NASA GSFC.

glow. They use far less energy than mercury-vapor or metal-halide lamps.

Government action?

In August 2008, the International Dark-Sky Association (IDA) worked with Congress on a bipartisan letter in support of light pollution research and education. Signed by 11 U.S. Congressional repre-

sentatives, it asked the U.S. Environmental Protection Agency (EPA) to take four steps against light pollution:

- 1) Codify a formal definition for "light pollution" that captures the detrimental effects that result from unchecked nighttime illumination.
- 2) Incorporate consideration of the environmental, safety, and health effects

Confronting light pollution: National Dark Sky Week

Each year, the International Dark-Sky Association (IDA) chooses one week during which they hope everyone in the United States helps to temporarily reduce light pollution. It's called **National Dark-Sky Week (NDSW)**. The IDA encourages us all to turn off unnecessary lights so we can realize the wonder that our universe holds. If everyone participates, NDSW will inspire us to use better lighting systems. NDSW was founded not only to reduce light pollution, but also to help people connect with the night sky.

NDSW usually occurs in April during the week of New Moon. This year, New Moon occurs April 25-30, across the United States,

amateur astronomers and concerned citizens will participate in NDSW each night between April 20 and April 26 from 10 p.m. to 12 a.m. EDT.

Besides raising awareness of the problem, NDSW's goals are to reduce light pollution temporarily; allowing us to see the night sky in greater detail; encourage people to use better light fixtures; and give everyone a greater appreciation for astronomy, thus recruiting others to help reclaim our dark skies lost because of poor lighting. If you want to get involved with NDSW, visit star parties and observatories that are hosting local events. — M. E. B.



With all the bad lighting in this photograph, it's tough to pick out the one light (arrow) that conforms to the full-cutoff standard. Michael E. Bakich

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Forget about astronomy for a moment. These streetlights produce so much glare that safety is the issue for drivers and pedestrians. *Michael E. Bakich*

of current levels of light pollution into EPA research programs.

3) Expand the discussion of well-designed (and thus energy-efficient) outdoor lighting in (the federal efficiency program) Energy Star publications and standards.

4) Support education about light pollution in the agency's education, outreach, and grant programs.

"Encouraging the EPA to address light pollution is a great first step at federal protection of our night skies," says Christian K. Monrad, president of the IDA Board of Directors. "We [IDA] estimate that there are approximately 2,500 outdoor lighting codes in the U.S. alone; some of them very well-written and others that are not. Having federal research and recognition of light pollution would

assist states and municipalities in having a solid baseline for future codes and revisions to current ones."

Moving to protect dark skies, Energy Star included specifications for full shielding of solid-state streetlights in its proposed criteria for 2009. If passed, the requirements will impact the design of all future LED (light-emitting diode) streetlights. These criteria are the result of input gathered at a series of Department of Energy (DOE) sponsored workshops.

Energy Star is America's most widely recognized energy efficiency program. It began in 1992 as a cooperative effort between the DOE and the EPA. Energy Star's primary goals are to save money and reduce environmental impact through energy-efficient products and practices. Visit the Energy Star web site at

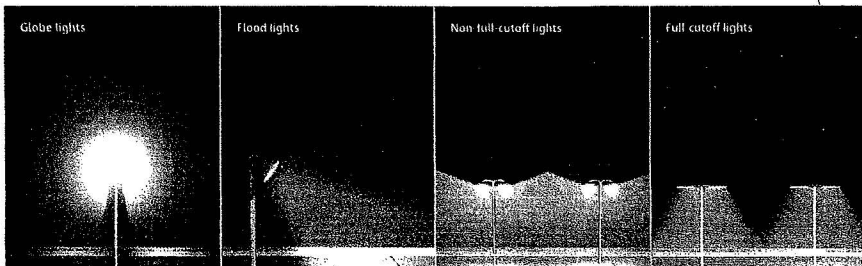
<http://www.energystar.gov> for more information about Energy Star's goals.

What can you do?

I talked to a leading vendor of approved light fixtures, Anthony Arrigo, president of Starry Night Lights. He's come up with 10 ways you can help in the fight against light pollution. They're listed here with only slight modifications:

1) Light only what needs lighting. This sounds simple, but it typically gets overlooked. Ask yourself, "Does this even require lighting?"

2) Light only when you need it to be lit. OK, so you've determined that it really requires light. Does it need to be lit at all times? If you go out to your shed only once a week, does it really need to be lit dusk to dawn every night?



Progressively better outdoor lights (left to right) reduce both glare and sky glow. The best lights employ full-cutoff shades, which direct light below the horizontal, sending the least amount of light into the sky. *Astronomy: Ron Kelly*

Fleeing light pollution: Arizona Sky Village

Many folks who seek a remedy for light pollution have taken up residence in premier observing locations. The country's most ambitious astronomical development is Arizona Sky Village (ASV).

Located in the foothills of the Chiricahua Mountains, ASV sits at the mouth of Cave Creek Canyon in Portal, Arizona. Four-acre lots of deed-restricted property and Interval Ownership Haciendas (time shares) occupy this expanse of high desert. Several dozen homes already populate the development.

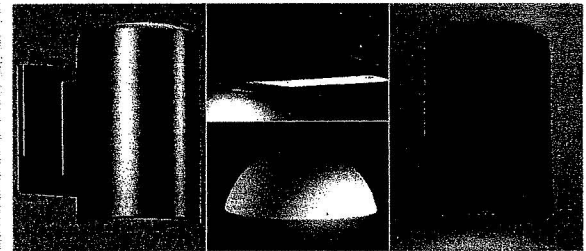
Arizona Sky Village is the vision of its first residents, Gene Turner and Jack Newton. Turner combines a lifelong fascination with astronomy with a career in real estate development to manage the project's nuts and bolts. Newton, a leading astromager for decades, is a household name among amateur astronomers. He's producing his best images ever from his observatory on the ASV site and also has discovered several supernovae.

ASV's sky is only a couple tenths of a magnitude brighter than the most remote locations on Earth. Southeastern Arizona enjoys a dry, yet moderate climate characterized by insignificant snow and tolerable summer heat. Its latitude is southerly enough to elude cold fronts and far enough west to remain dry.

Developments such as Arizona Sky Village represent the future of dark-sky astronomy. Filling desirable locations with amateur astronomers can only help to keep light pollution at bay. — M. E. B.



This light fixture, installed when a restaurant opened, is an example of extreme light pollution because of the amount of light it emits horizontally. People with no interest in astronomy complained about it from the first night it went into operation. *Michael E. Bakich*



This selection of IDA-approved lighting is part of the line offered by Starry Night Lights. As these examples show, full-cutoff lights don't have to be ugly to be effective. Images courtesy starrynightlights.com

3) Use only as much light as is required. Don't always install the highest available wattage. If you're not performing surgery on your patio, there's no need for operating room illumination levels.

4) Use only full-cutoff light fixtures. Full-cutoff fixtures shine light onto the ground and prevent light from crossing property lines or up into the night sky.

5) Shield existing fixtures. If you're not quite ready to install new, full-cutoff fixtures, light shades are available for many fixtures. Shades will convert the fixtures into night-sky friendly fixtures for a minimal cost.

6) Install motion sensors. Such devices will turn your lights on automatically

whenever there is activity outside your home or business. Taking this step typically reduces your use of electricity for lighting by more than 90 percent. Such a saving easily pays for the cost of the sensor and its installation.

7) Install reflectors. Many times, you can use reflectors to outline a driveway instead of a string of lights. Reflectors are cheaper to purchase, cost nothing to run, and are unaffected by power outages.

8) Get used to the dark. Our eyes are quite good at night. If you take the trash out at night, do you need to turn your outdoor lights on? Chances are good that you'll be able to find the trash can and make your way to the curb.

9) Educate those around you about light pollution. This includes your family, friends, neighbors, and elected officials. With just a little bit of thought and effort, light pollution is one type of environmental problem that can be cleaned up without any side effects.

10) Show your support for current efforts. Help promote groups such as the International Dark-Sky Association and manufacturers who produce approved fixtures. If you blog, write about light pollution. Don't just gripe! Mention success stories whenever you can.

Taking a proactive approach to light pollution ensures that future nights will be safe, healthy, and dark. »



WINDWARD AHUPUA'A ALLIANCE

From the Peaks of *Na Ko'olau* to the Outer Reefs

*Community-Based Planning
Sustainable Economic Development
Restoration, Preservation, Protection & Public Access
Educational & Cultural Programs*

COMMITTEE ON ENERGY & ENVIRONMENTAL PROTECTION

*Rep. Hermina Morita, Chair
Rep. Denny Coffman, Vice Chair*

Bill No. 536

COMMITTEE ON WATER, LAND & OCEAN RECOURSES

*Rep. Ken Ito, Chair
Rep. Sharon Har, Vice Chair*

Support Y N

Date 3/23/09

SB 536 SD1 - RELATING TO STARLIGHT RESERVE

Support

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PUBLIC HEARING

9 am

Tuesday, March 24, 2009

Conference Room 325

Type 1 2 WI

My name is Shannon Wood speaking on behalf of the *Windward Ahupua'a Alliance* in support of SB 536 SD 1- RELATING TO STARLIGHT RESERVE.

From 1991 until the end of 2005, my husband and I operated a small "boutique" visitor industry business called *A GUIDED TOUR OF THE GALAXY* in which we took people out under Hawai'i's night skies for an experience available nowhere else in the United States.

Unfortunately, the night lights on O`ahu made it more & more difficult to provide a high-quality stellar viewing experience so we reluctantly shut it down. However, as semi-serious amateur astronomers, we still go out ourselves to look at the night skies.

The concepts in this legislation are clearly articulated and well-drafted. However, I do continue to have some concerns about administrative costs as no money has been included. Can this advisory committee be tucked into *DBEDT's* proposed budget?

Nevertheless, the legislation will have a huge impact on not just the visitor industry but also the entire field of astronomy everywhere across the state.

We urge that you pass SB 536 SD1 - RELATING TO STARLIGHT RESERVE. *Mahalo* for the opportunity to submit testimony.