Dark & Quiet Skies

2024/2025 Updates

AAS Committee for the Protection of Astronomy and the Space Environment

Sam Lawler - University of Regina
Teznie Pugh - University of Texas at Austin, McDonald Observatory
Aparna Venkatesan - University of San Francisco
Michelle Wooten - University of Alabama at Birmingham

April 3, 2025 – NASEM - Committee on Astronomy and Astrophysics

Picture: Stephen Hummel
McDonald Observatory

Introduction

COMPASSE represents the interests of AAS relating to the protection of dark and radio-quiet skies, the safe and sustainable use of outer space, and related issues, and empowers AAS members to be effective advocates for the protection of U.S. astronomy.

Primary Concerns: *Impacts on access to the night sky and impacts on astronomical science:*

1. ***Commercialization of orbital space (Satcons)***
2. ***Artificial light at night (ALAN)***
3. ***Preservation of observational environments***

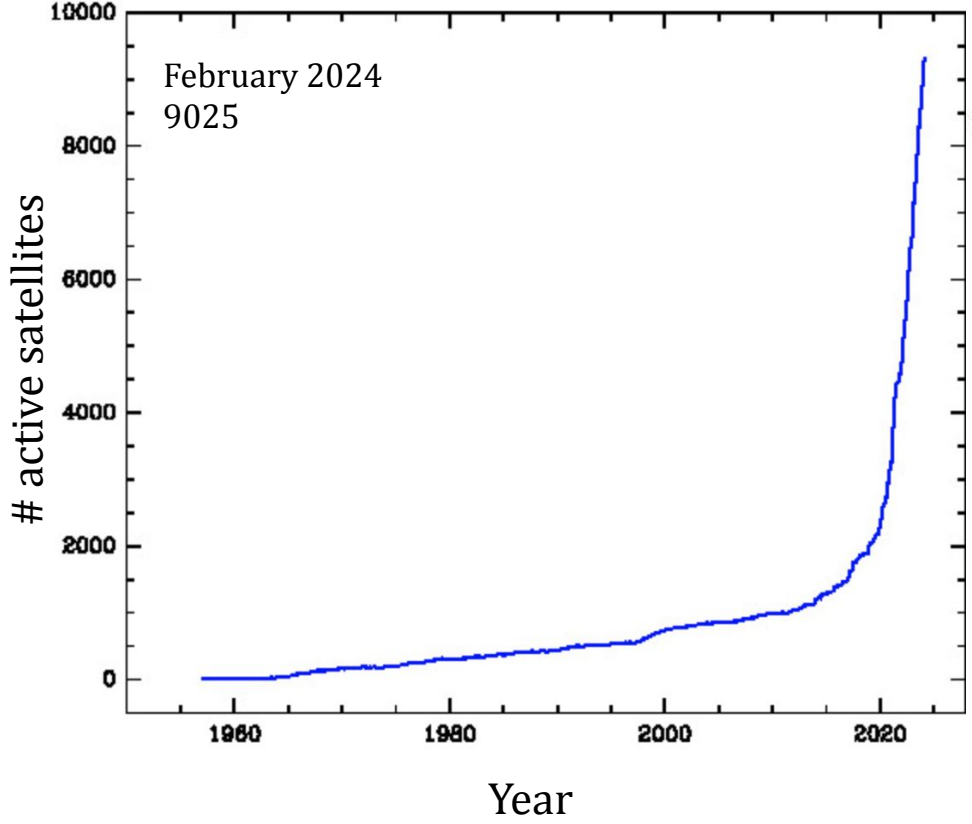
AAS Committee for the Protection of Astronomy and the Space Environment (COMPASSE)

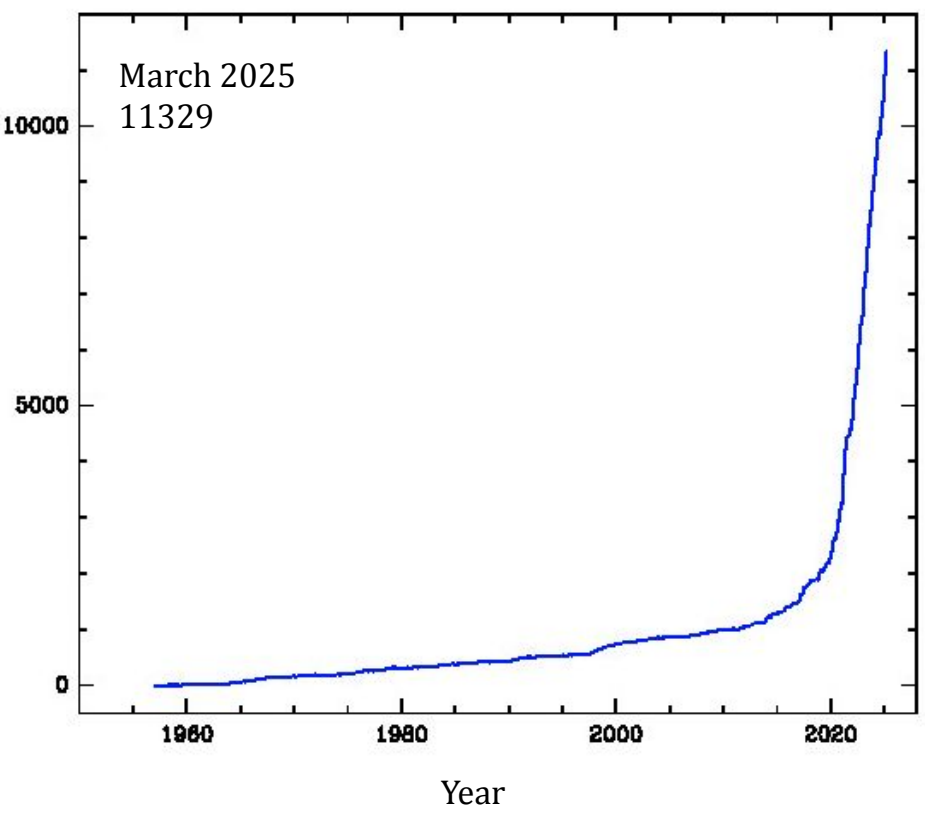
Outgoing co Chairs:
Teznie Pugh and Aparna Venkatesan

Incoming co-chair
Sam Lawler

Incoming co-chair
Michelle Wooten


SATCONS
Picture: A. H. Abolfath
NOIRLab/NSF/AURA





Data: J McDowell - CFA

Impacts of Satellite Constellations

- Observatories
- Accessibility of night sky to general public
- Orbital crowding and orbit sustainability
- Re-entry and deorbit events

- Concerns & questions?
  - Sale of radio frequencies
  - Future of TraCSS @ OSC
  - Future of NSF coordination agreements
  - Combination, closure, pauses of committees and offices related to policy within NSF, NASA, and others
  - Solar power from space, SCS, Space advertising

COMPASSE & AAS Work

Statements for AAS

Statement on Space Transparency
Statement on Atmospheric Impacts of Spacecraft Reentries and Launches
Statement on Intrusive Space Advertising
Comment on Proposed FCC Rulemaking on Supplemental Coverage from Space

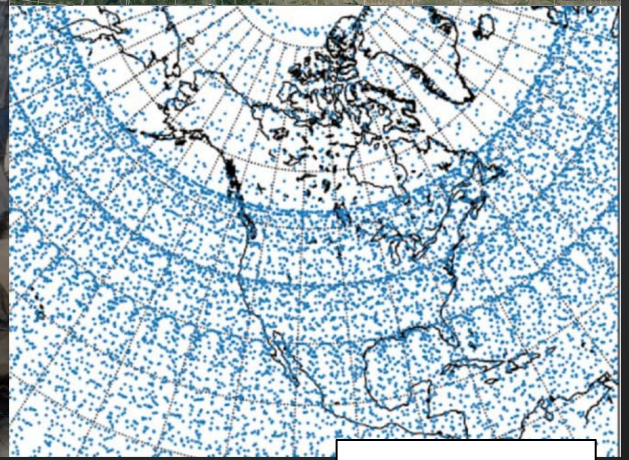
Activities

UN COPUOS Group of Friends State Department Advisory Committee
Comments: FCC, NTIA
IAU involvement


AAS | 245
245TH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY
NATIONAL HARBOR, MARYLAND 12–16 JANUARY 2025
Thursday, 16 January 2025, 2:15 pm EST (19:15 UTC)
Press Conference
Galactic Histories and Policy Futures

Space Debris on the Ground

J. McDowell

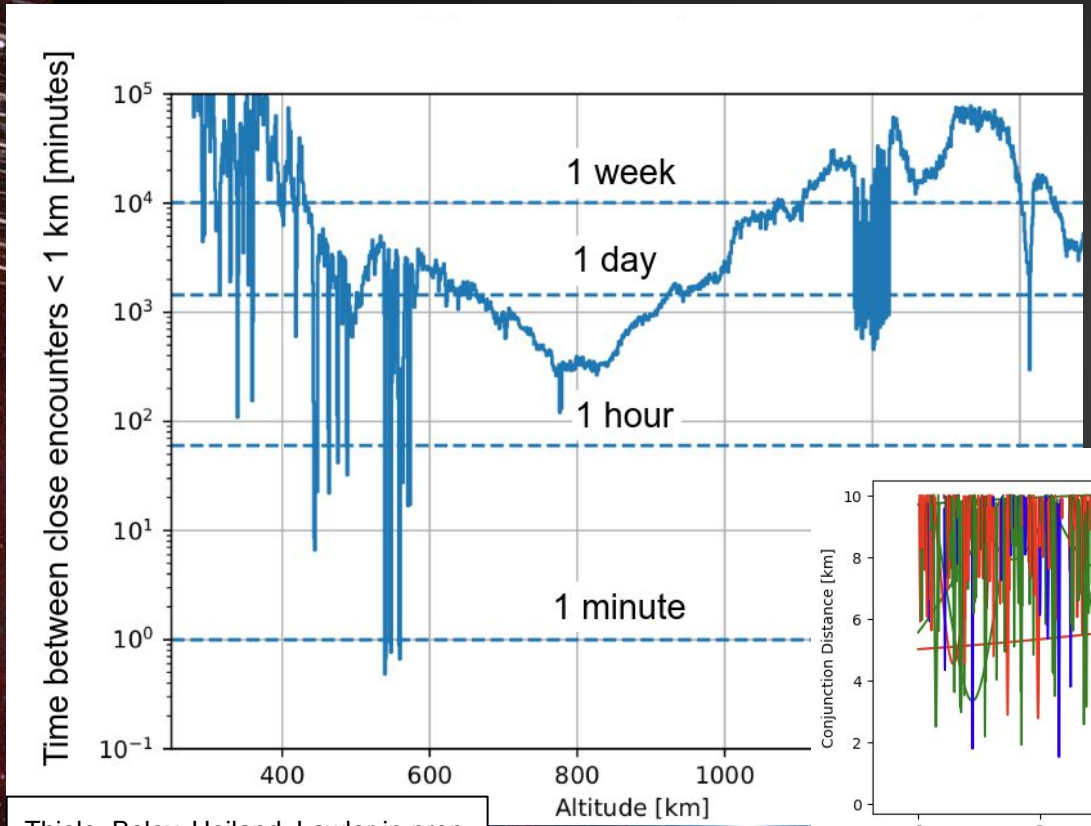


Lawler et al. 2022

Pieces of a Crew Dragon trunk were found in Saskatchewan in April 2024

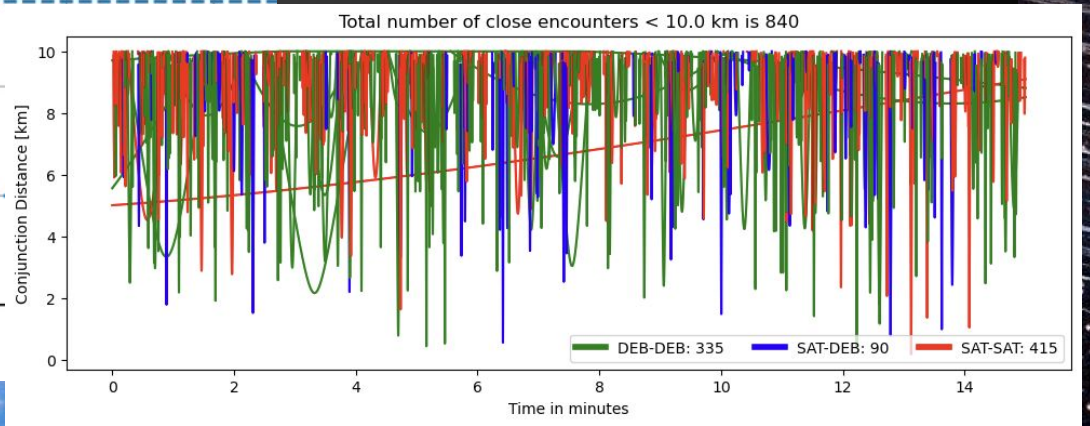
A piece of a Starlink satellite was found in Saskatchewan in August 2024

Frequent close approaches in orbit



Thiele, Boley, Heiland, Lawler in prep

Collision risks in orbit are high. So far, collision avoidance has worked well, but orbital conjunctions are increasing in frequency as more satellites are launched

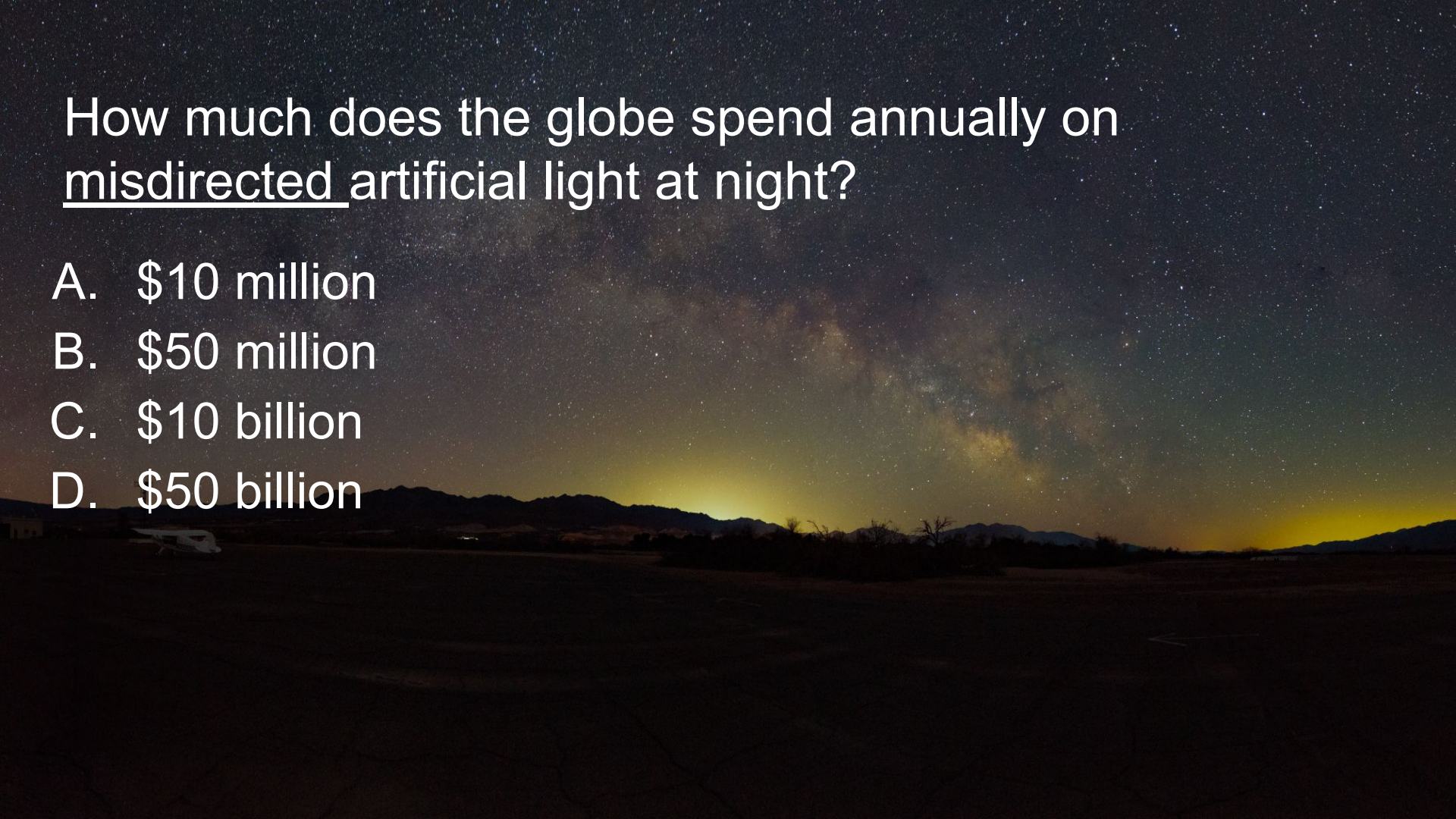


Ground-based Light Pollution

from Artificial Light at Night (ALAN)

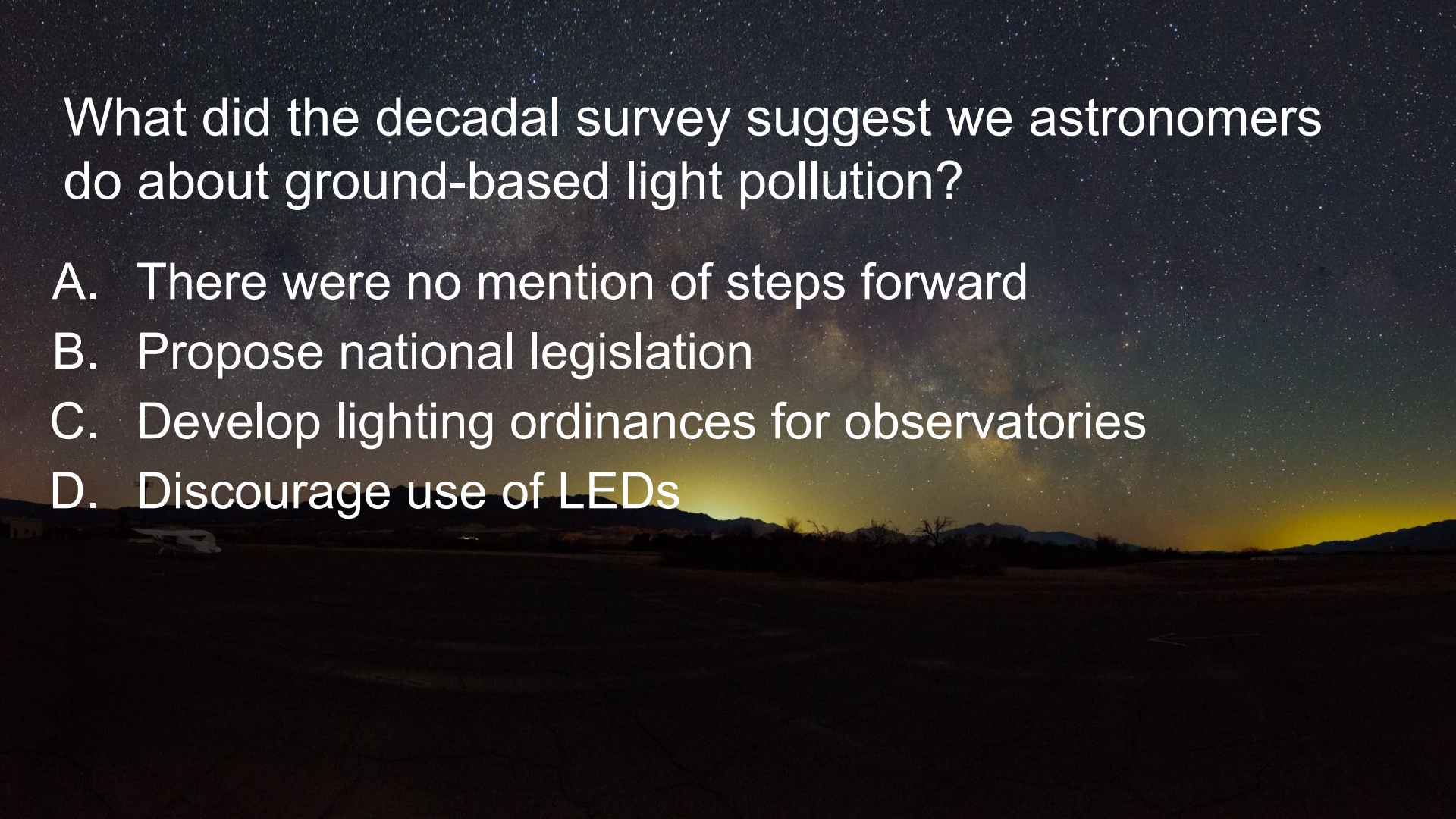
Which of the following does ground-based light pollution NOT impact?

A. Observations from ground-based observatories
B. Accessibility of the night sky to the general public
C. The towel in your bathroom
D. Human and environmental health



How much does the globe spend annually on misdirected artificial light at night?

A. $10 million
B. $50 million
C. $10 billion
D. $50 billion



What did the decadal survey suggest we astronomers do about ground-based light pollution?

A. There were no mention of steps forward
B. Propose national legislation
C. Develop lighting ordinances for observatories
D. Discourage use of LEDs

Successes Across Advocacy Communities (2024 - 2025)

- COMPASSE Light Pollution Subcommittee
  - Letter to Department of Energy (DOE)
  - Collaborations
  - Workshops

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- DarkSky International
  - Municipal Lighting Ordinance Template
  - State Lighting Ordinance Template

https://darksky.org

Lenovo Support | Lenovo | McAfee | Accounts - chase.com | Home - Google Drive

DarkSky | Who we are | What we do | Get involved

What we do

International Dark Sky Places

We certify and help conserve starry sky parks, communities, and other places around the world.

Find a Place

DarkSky Approved lighting

We certify lighting products, designs, and installations that reduce light pollution.

Search products

Advancing responsible outdoor lighting

We work with communities and professionals to establish codes and statutes that reduce light pollution.

View codes and statutes

Light pollution education

We inform the public how excessive artificial light can harm humans, wildlife, and our climate.

[MUNICIPALITY] OUTDOOR LIGHTING ORDINANCE

Note: Italicized and capitalized words and phrases are defined in section 4.0 Definitions.

1.0 PREFACE

1.1 Authority

On behalf of the [municipality], this outdoor lighting [ordinance] is enacted on [date] pursuant to, and in accordance with, the authority of the [city council].

1.2 Purpose

[A municipal outdoor lighting ordinance should first establish a purpose and thoughtful background information regarding the intent for having one. When allowed, this information is important for future decision makers who will be faced with new and unique requests. While preamble and background narratives are not usually accepted as code or bylaw, recitals are an effective way to incorporate background and intent. Recitals must be factual, not general, and kept to a minimum.]

A. This outdoor lighting [ordinance] is intended to protect the health and welfare of all residents within the [municipality], enhance its [character and quality of life], prevent inappropriate and poorly installed outdoor lighting, reduce lighting conflicts between property owners, prevent the increase of potentially harmful sky glow, and preserve the naturally dark sky for the benefit of residents, visitors, wildlife, and the environment. The *Five Principles for Responsible Outdoor Lighting* will guide [municipality]'s outdoor lighting decisions because:

1. Whereas, outdoor uses of *Artificial Light at Night* (*ALAN)* often include inappropriate and bright sources of light that cause an unsafe reduction in human visual performance; and

2. Whereas, excessive, unnecessary, and misdirected *ALAN* contributes to *Light Pollution* and wastes energy resources that would, if corrected, generate tangible cost savings; and

3. Whereas, increased use of *ALAN* has contributed to an escalation of *Light Pollution*, thus increasing the brightness of the night sky by 10% annually and rendering the current night sky orders of magnitude (often hundreds of times) brighter than the natural and original sky background; and

4. Whereas, *Light Pollution* from *ALAN* is known to cause adverse effects on the health and well-

2.0 OUTDOOR LIGHTING REQUIREMENTS

2.1 General

A. **Legal:** All outdoor *Luminaires* and *Luminaire* installations shall comply with federal and state law; county and municipal codes; applicable energy and building codes; product safety labeling; the requirements of this [ordinance]; and shall be subject to the appropriate permit and inspection requirements thereof.

B. **Light Level:** Unless otherwise specified in this ordinance, lighting installed for an outdoor use shall not exceed 25% more than the *Light Level* recommended by the applicable *ANSI/IES Lighting Standard*, or a state approved alternate, as published by [enactment date].

C. **Distribution:** Unless otherwise specified in this ordinance, *Luminaires* emitting more than 1,000 *Lumens* shall be *Fully Shielded* and shall emit no more than 5% of their total *Lumen* output above 80 degrees from *Nadir*. Exceptions are:

1. Festoon string lighting where no individual lamp emits more than 50 lumens, and the lumen density of the string is no greater than 25 lumens per foot. *[This will restrict some medium-base line-voltage products that are not recommended unless they are shielded.]*

2. Directional *Luminaires* used for façade illumination which are shielded and aimed to hit their target such that the light is contained by architectural elements.

D. **Trespass:** Unless otherwise specified in this ordinance, *Light Trespass* shall meet the following:

1. *Luminaire* light sources shall not be visible from federal or state designated wilderness, natural area, habitat, or reserves, and *Light Trespass* shall measure no greater than 0.1 *Lux.*

2. *Light Trespass* onto Waters of the United States shall measure no greater than 1 *Lux*.

3. *Light Trespass* onto *Residential Use* property shall measure no greater than 1 *Lux*.

E. **Curfew:** *Non-essential* outdoor lighting, including but not limited to landscape and decorative lighting elements, shall be extinguished during *Nighttime Hours*.

1. When applicable, outdoor lighting shall dim or be extinguished during *Nighttime Hours* as prescribed by an adopted energy code.

Current Efforts

Efforts

- National Legislation
- Campus SHINE:
  Safe and Healthy Illumination for the Nighttime Environment

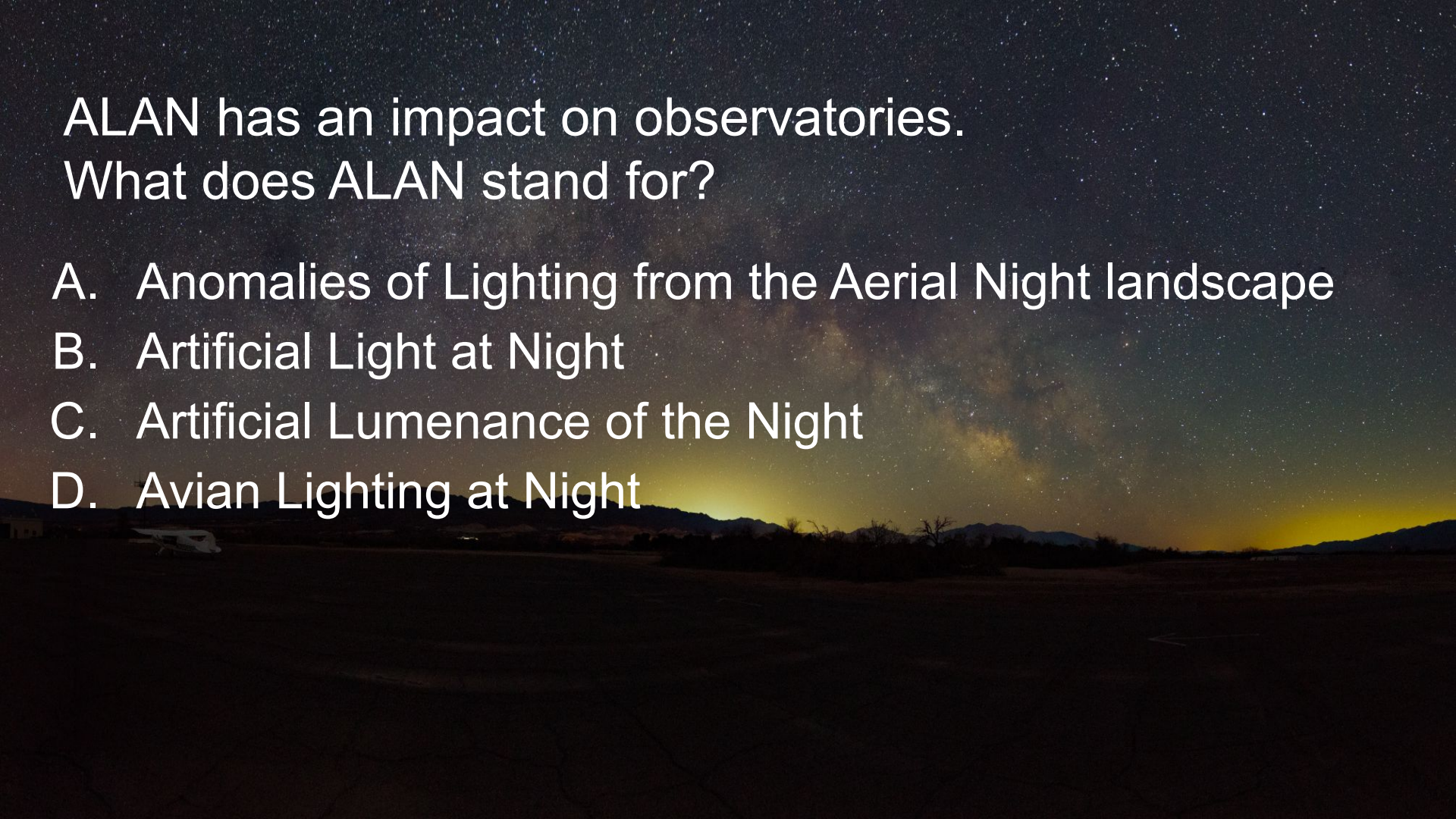
CAMPUS SHINE

HOME RESOURCES CONTACT

Current Asks

Asks

- Observatories



ALAN has an impact on observatories.
What does ALAN stand for?

A. Anomalies of Lighting from the Aerial Night landscape
B. Artificial Light at Night
C. Artificial Lumenance of the Night
D. Avian Lighting at Night

https://www.zotero.org/groups/2913367/alan_db/library

Lenovo Support | Lenovo | McAfee | Accounts - chase.com | Home - Google Drive

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Groups | Documentation | Forums | Get Involved | Log In

Title, Creator, Year

Other Group Libraries

ALAN_DB

Title	Creator	Date
"Astronomical Tourism": The Astrono...	Collison and Poe	2013
"Chrono-functional milk": The diffe...	Asher et al.	2015
"Dark Sky Parks" as measure to supp...	Labuda et al.	2015
"Detection of factors influencing cir...	Padilla-Martinez et al.	2020
"You Know the Pyrenees by Day - Co...	Charlier	2018
«Det lyser i hyttegrender av tindra...	Rue	2024
0038 Sleeping with Low Levels of A...	Mindel et al.	2019
012 Overnight light exposure acute...	Grimaldi et al.	2021-05-01
0306 Circadian Disrupting Light E...	Fidler et al.	2023-05-01
11 Pressing Research Questions o...	Hölker et al.	2021
120 HZ Variations in Sky Brightness...	Crabtree et al.	1991
2010 U.S. Lighting Market Characte...	Ashe et al.	2012-01-01
2015 International Year of Light and ...	Vozzi and Ramponi	2016
2015 U.S. Lighting Market Characte...	None	2017-11-30
2015 U.S. Lighting Market Characte...	Buccitelli et al.	2017-11-30
2020 U.S. Lighting Market Characte...	Lee et al.	2024-04-01
25 years of light-induced petrel gr...	Chevillon et al.	2022-10-01
258 Blue Blockers' Ability to Block ...	Bobadilla et al.	2021-05-01
40-year (1978-2017) human settle...	Gong et al.	2019

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Animals | Ecology | Human health | Lighting | Planning | Plants | Remote sensing | Review | Skyglow

*Acclimatization | *Acropora | *Adaptation | *Adolescent Behavior/drug effects | *Aged

Current Asks

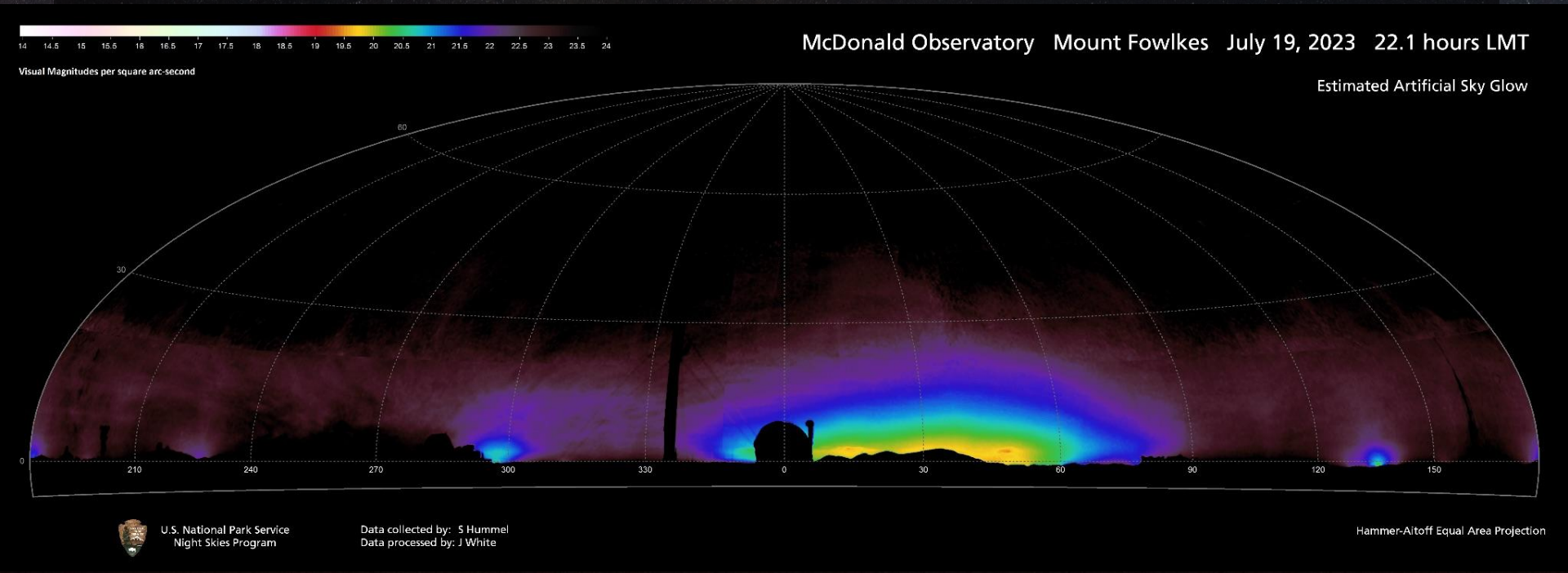
Asks

- Observatories
  - Each site sets its own limits for growth of ALAN and how it protects itself
  - **Asks: Agencies support regional management**
    Examples: measuring and modeling

Measuring and modeling example: SQM LU-DL from Unihedron

Measuring and modeling example: SQM LU-DL from Unihedron

Measuring and modeling example: All Sky Image from McDonald Observatory



Current Asks

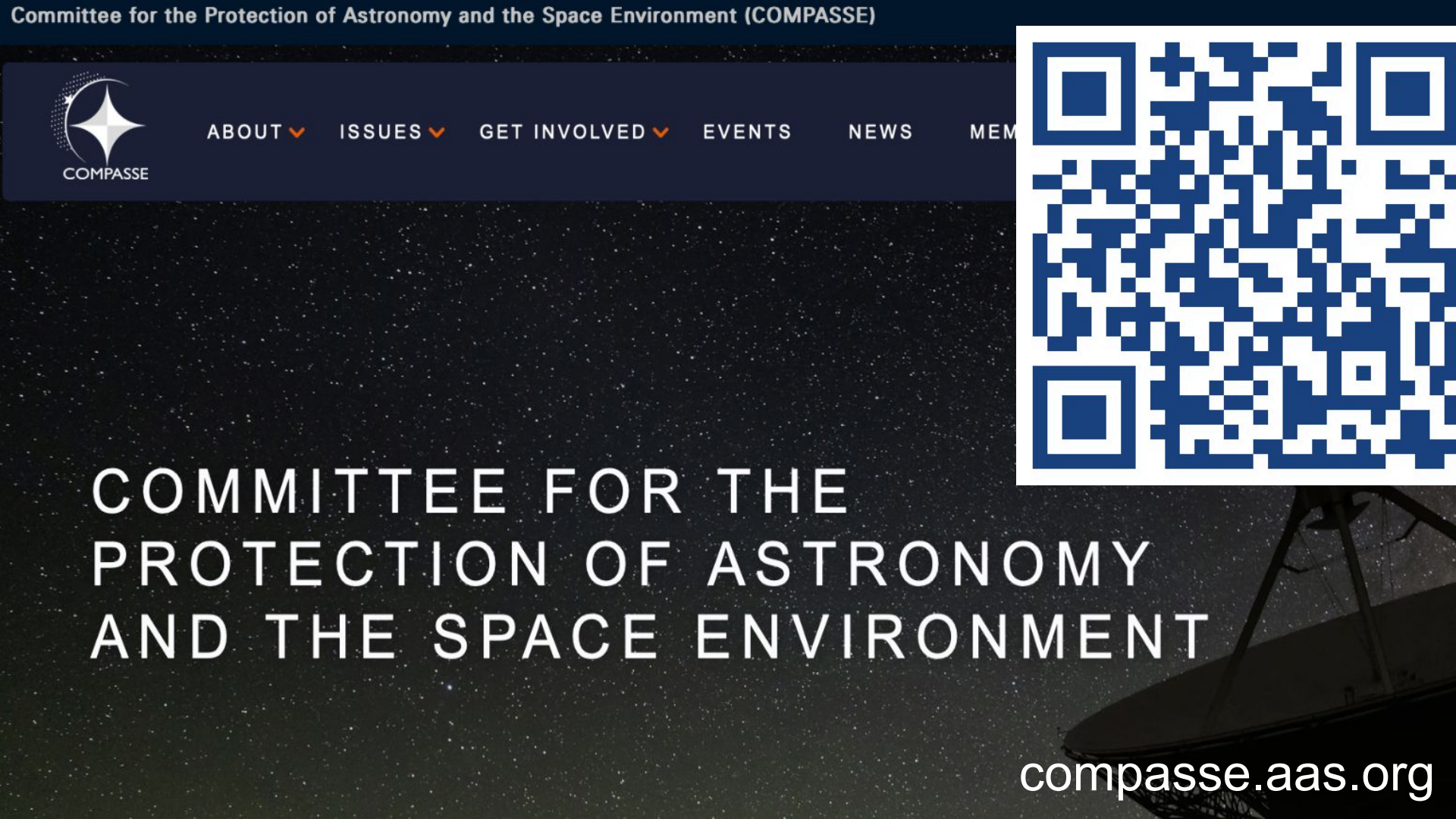
Asks

- Observatories
  - Each site sets its own limits for growth of ALAN and how it protects itself
  - **Asks: Agencies support regional management**
    Examples: measuring and modeling
- Measuring growth of light pollution globally
  - **Asks: Earth observing data maintained for public & scientific use**

Supporting the Foundations for Astronomy and Astrophysics

Reflections mid-decade on Astro2020's recommendations related to COMPASSE work (dark skies, spectrum management and protections, supporting community astronomy models)

Deep concerns at current time over loss of observing programs, opportunities, data, and facilities/assets; implications for US science and scientists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