



**The National and  
International  
Landscape Concerning  
Dark and Quiet Skies**



**Prepared by the International Astronomical Union Centre for the Protection of the Dark and Quiet Sky, Policy Hub, Work Package 2 Working Group**

## **Preamble**

The Policy Hub of the International Astronomical Union's Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference (IAU CPS) established a Working Group to review and examine national and international laws and policies concerning orbital light pollution. The effort, called Work Package 2 (WP2), greatly expands upon the national analyses in the Dark and Quiet Skies II report and reexamines several fundamental aspects of the corresponding international analysis. Most analyses were completed during 2023.

A driving theme of the work is to understand what state obligations, laws, and policies already exist to protect dark and quiet skies, especially with respect to state interests in conducting astronomical observations. The work further provides several recommendations to the IAU CPS that are complementary to the CPS Position Paper.<sup>1</sup>

WP2 includes an extended compilation of national laws and regulations conducted by the National Team (Y. Yakushina et al. "National Approaches to the Protection of Dark and Quiet Skies". IAU CPS, 2024). <https://doi.org/10.5281/zenodo.14566125>.

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<sup>1</sup> IAU CPS. Call to Protect the Dark and Quiet Sky from Harmful Interference by Satellite Constellations. March, 2024. <https://cps.iau.org/documents/49/techdoc102.pdf>

A further contribution to WP2 is an examination of the United Nations Declaration of the Rights of Indigenous Peoples<sup>2</sup> (UNDRIP) with respect to the exploration and use of outer space (H. Neilson. “Indigenous Rights and Perspectives with respect to Outer Space”. In proceedings IAUS385, 2025).

In November 2023, the Outer Space Institute (OSI) convened the Astro-Sat workshop in Vancouver, in part to help facilitate an exchange of ideas and promote dialogue between the WP2 Working Group and other experts. A discussion paper was circulated to all participants in advance of the meeting. Following the workshop, a list of possible “action items” was developed to aid in guiding further efforts to protect dark and quiet skies. Public versions of both documents are available through the Outer Space Institute (outerspaceinstitute.ca). See also <https://doi.org/10.5281/zenodo.14579374>.

The WP2 Working Group members include astronomers, lawyers, historians, policy makers, and social scientists. They are all volunteers, and no remuneration was given for their services. Some travel support was made available to Working Group members for enabling participation in related workshops and conferences.

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<sup>2</sup> United Nations. United Nations Declaration on the Rights of Indigenous Peoples. 6/295. September, 2007. [https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP\\_E\\_web.pdf](https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf)

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# Executive Summary

Minimizing harm from orbital light and spectrum pollution requires global action. However, there is not a single forum, way, or method for that action to take place. Instead, there are multiple levels of governance that must be considered when exploring what steps are available now and how new rules or guidelines could be developed or clarified. While this presents its own challenges, there is potential for existing legal and policy frameworks to advance efforts in protecting dark and quiet skies, provided there is substantial coordination nationally and internationally.

This report presents the findings of the Work Package 2 Working Group's (WP2WG) analyses of national and international laws and policies mainly concerning orbital light pollution. On the national and even local levels, light pollution laws, regulations, and policies were analyzed for more than 70 countries out of the 102 member states of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). Space regulatory frameworks were also examined to determine whether (1) astronomy or astronomical observations are explicitly viewed as part of a state's space program, (2) they are not included either way, or (3) they are excluded explicitly. This greatly expands upon previous examinations in complementary reports, such as *Dark and Quiet Skies II*.<sup>3</sup> The analysis does not include a detailed examination of national licensing and authorisation practices for satellites and other space objects; nor does it include a detailed analysis of radio spectrum regulations. However, it does provide a general overview of radio spectrum regulations, as well as a brief analysis of those provisions that relate to satellite regulations, focusing on those with potential relevance to dark and quiet skies.

The international analysis reviews state obligations regarding the exploration and use of outer space under international law and principles, as well as commitments to international guidelines. As with the national analysis, the work builds upon previous examinations, addressing whether (1) astronomy or astronomical observations are an exercise in the exploration and use of outer space under international law, (2) states have obligations to mitigate light pollution under international law, (3) launching states are internationally liable for damage to observatories caused by the loss of astronomical data, and (4) there are gaps in previous international law analyses.

## I. National Analysis Results

There is a lack of clarity regarding the way countries<sup>4</sup> view the nature of astronomical observations. This conclusion is based on analyses of both laws and policies. Nonetheless, the lack of clarity should not be interpreted as a statement either way on how countries view astronomical observations. Rather, the need to clarify the nature of astronomy is relatively new.

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<sup>3</sup> Working Groups. *Dark and Quiet Skies II Working Group Reports*. C. Walker and P. Benvenuti (eds.). 2022. <https://zenodo.org/records/5874725>

<sup>4</sup> The National Analysis Team uses the term "countries" throughout their analyses and summaries to avoid potential confusion with governance structures used in some states. The international analysis, as well as report summaries, use "state" to be more consistent with international usage. Unless noted otherwise, the terms are used interchangeably for the purposes of this report.

From a national perspective, advocating for new national laws and policies regarding astronomy could be constructive, but could prove to be challenging as an initiative on its own (see international discussion). To foster rapid and flexible progress, national approaches could, in parallel, continue to explore options of implementing national environmental and light pollution mitigation regulations, including by breaking down artificial barriers that have been used to create separate “Earth” and “Space” environments. This exploration can build upon recent national conversations by some countries on the necessity to protect dark and quiet skies (D&QS) for astronomical observations, particularly countries with large investments in astronomical infrastructure.

Looking beyond policy and legislation, many countries have initiatives that seek economic benefit from or otherwise see value in conserving D&QS. Examples include astro-tourism, environmental conservation areas, such as dark sky reserves, and the advancement of astronomical observations themselves.

Currently no singular “best regulatory approach” to law or policy to reduce orbital light pollution can be identified due to the complexity and variety of approaches implemented by different countries. A more unified approach to the issue should be developed at the international level.

Light pollution can be interpreted as a form of environmental pollution in some countries, as defined in existing regulations and policies. This occurs through two primary mechanisms: (1) within national environmental laws, including “energy pollution” or (2) by directly identifying excessive or unwanted light as a pollutant. Nuisance lighting rules may offer a path for new rulemaking, such as addressing space-based advertising.<sup>5</sup>

## **International Analysis Results**

The legal and policy analyses resulted in a general view that the provisions of the Outer Space Treaty (OST), particularly Article IX, create obligations for states to show due regard and to limit interference with astronomical observations carried out by other states. Additional policy analyses and a treaty interpretation of the OST were further reviewed, leading multiple WP2WG members to go further and conclude that astronomical observations are a form of exploration and use of outer space under international law.<sup>6</sup>

In either case, there is a view that states must take into account impacts on astronomical observations as part of their international obligation to authorize and supervise national activities that use or explore outer space.

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<sup>5</sup> A short review of space-based advertising is available at R. Cochetti. Are we ready for space-based advertising? The Hill. December, 2022. <https://thehill.com/opinion/technology/3760766-are-we-ready-for-space-based-advertising/>. A recent launch of test satellites to conduct such advertising is reported by Brett Tingley. Russia launches new Angara A5 heavy-lift rocket on 4th orbital test mission. Space.com. April, 2024. <https://www.space.com/russia-1st-post-soviet-rocket-angara-a5-fourth-test-launch>

<sup>6</sup> G. Rotola and A. Williams 2021, "Regulatory Context of Conflicting Uses of Outer Space: Astronomy and Satellite Constellations", *Air and Space Law*, 46, 4/5, 545-568. <https://doi.org/10.54648/aila2021031>. M. Byers and A. Boley 2023, *Who Owns Outer Space? International Law, Astrophysics, and the Sustainable Development of Space*, Cambridge University Press. <https://doi.org/10.1017/9781108597135>

However, because the national analyses showed that there is a lack of clarity regarding how states view astronomical observations, there needs to be an international effort to clarify astronomy’s legal status or the duty of states to show due regard toward astronomical observations.

The international analysis noted that while terrestrial environmental law has evolved significantly in recent decades, developing an understanding of how environmental law applies to outer space has lagged. Notable exceptions are in addressing space debris, but this has arguably been treated as a separate problem rather than part of a larger environmental issue. An opportunity exists to make stronger connections, especially with the growing realization of the interconnectivity between overcrowding orbits, space debris, atmospheric pollution, and light and spectrum pollution.

The International Telecommunications Union (ITU) could play a larger role in addressing many of the issues that result from overcrowded orbits. Spectrum pollution is already well within the ITU’s mandate, but light pollution is not. With this in mind, better ITU oversight regarding the distribution of satellites may have important implications for satellite light pollution. Moreover, while expanding the ITU mandate to include light pollution may not be possible or desirable, ITU study groups could be effectively used as a forum for discussing light pollution issues within the context of addressing broader space sustainability challenges.

International liability and its use to address damage to the night sky from light pollution is not viewed as a viable legal pathway for protecting D&QS. However, damage to astronomical data could be, as data are a type of property and the argument that such damage is within the object and purpose of the Liability Convention is at least tenable. Nonetheless, invoking it could come with great political costs to the states involved, which would tend to discourage states from pursuing this option. Yet, the threat of invoking the Convention could be a useful tool for shaping state behaviour, serving as a form of leverage in international negotiations.

Moving forward, there is a clear need to combine national and international initiatives, fostering synergy between them and exploring multiple paths forward in parallel. Those initiatives should ultimately be focused on providing clarity regarding the legal and policy avenues identified so far. This is seen as being more fruitful than searching for additional gaps or additional state laws and policies that could be activated, as the most influential actions that could be taken are those that help to shape state practice, as well as engage in local, national, and international forms of governance simultaneously.

## **Report Structure**

The remaining report consists of two extended research synopses followed by recommendations to the IAU and the IAU CPS. The synopses cover the national analysis and the international analysis in turn. These are complemented by two annexes offering insight from team members, as well as the detailed national analyses (Yakushina et al. 2024) and the “Indigenous Rights and Perspectives with respect to Outer Space” analysis (Neilson 2024). Regarding the recommendations, because this work has been ongoing for over a year, early findings have been communicated to the IAU CPS, and in some cases, action has already begun.

# Synopsis of Analyses

## NATIONAL ANALYSIS

### 1. Introduction

During the last few years, the protection of D&QS has received increasing attention at different political and regulatory levels. This has been prompted by the proliferation of artificial light at night (ALAN) and the number of megaconstellation satellites being placed into low Earth orbit (LEO).<sup>7</sup> These changes have created a complex set of concerns, ranging from impacts on astronomical activities to environmental protection that can no longer be ignored by national governments.

This section highlights research results conducted by the WP2WG National Analysis Team. It identifies policy and legal approaches to protecting D&QS in various jurisdictions across the globe. The section further summarises the key findings of the research, provides examples of national approaches to protecting D&QS, and identifies future research opportunities and actions.

Previous research, such as that in the Dark and Quiet Skies II report,<sup>8</sup> has shown that several countries have adopted legislation to preserve the sky for astronomical activities. Building upon that work, the current analysis provides a detailed synthesis of the adopted policies and legislation in a broader range of countries.

This analysis further shines light on how countries perceive astronomy and astronomical observations, evaluates whether and how they address orbital light pollution, and scrutinizes other provisions relevant to the protection of D&QS.

Altogether, the analysis builds a broader understanding of the legal and policy challenges that the astronomical community faces across different countries, and provides initial recommendations on how to potentially overcome these obstacles to preserve D&QS.

### 2. Research

The analysis of national regulatory approaches to protecting D&QS requires an in-depth review of relevant formal, written policies, as well as legal documents. It also must consider domestic and local initiatives that may facilitate and promote the adoption of D&QS policies and laws at the national level. Such a comprehensive approach not only provides insight into the current state of affairs but also enables an assessment of the prospects for enacting innovative legislation aimed at protecting D&QS.

The national analysis includes three stages. The first stage reviews the overarching D&QS frameworks adopted by different countries. This is done by (1) identifying which countries to include in the analysis and (2) exploring how those countries address the preservation of D&QS.

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<sup>7</sup> Perez, A., 2023, Science, 380, 1136-1140. <https://doi.org/10.1126/science.adg0269>

<sup>8</sup> Dark and Quiet Skies II Working Group Reports, 2021, IAU, UNOOSA, Spain & NOIRLab. <https://doi.org/10.5281/zenodo.5874725>



Countries were selected based on membership in the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), which currently comprises 102 member countries. The research also included a small number of countries with astronomical facilities that are not part of UNCOPUOS to provide a more comprehensive perspective on D&QS concerns. Legislation and policies of more than 70 countries were analysed for the purposes of this research.

To investigate national regulatory approaches at the first stage, the work addressed a range of research questions (RQs) including but not limited to: (1) are astronomical activities considered to be space activities within the national legislation; (2) are there any specific norms to protect astronomical observations; (3) are there any light pollution/dark sky protection laws; and (4) what other laws can be applied to protect astronomical observations?

In the second stage of the analysis, the research went beyond general D&QS frameworks and briefly examined the legal and policy approaches related to the authorization and licensing of satellites, including environmental impact assessments. To help focus the analysis, the following RQs were addressed: (1) what are the national regulations for satellite authorization; (2) what are the national regulations for satellite licensing; (3) are there any specific requirements for satellite megaconstellations; and (4) are there any considerations for potential impacts on D&QS? This stage is especially important for analyzing launching states.

Finally, in the third stage, the overall conclusions elucidated how and to what extent countries protect D&QS. Recommendations to improve such protection were also drawn.

Another important aspect of the research is related to the use of terminology, primarily because of the distinct nature of national space legislation. Unlike the international space legal regime, such as the Outer Space Treaty (OST) of 1967,<sup>9</sup> which introduces the phrase “peaceful use and exploration of outer space”, individual nations tend to use the term “space activity” to mean activities that engage in the peaceful use and exploration of space. Thus, this research analyzes the protection of D&QS for astronomical observations also by examining how the concept of space activity is defined within national frameworks. Such examination helps to assess the potential for legal recognition of astronomy as a space activity.

### **3. Research Results**

#### ***3.1. Are astronomical activities considered an exercise of the exploration and use of outer space within the national legislation?***

As previously noted, the international concept of “peaceful use and exploration of outer space”, is often articulated at national levels through the term “space activity”. In addressing RQ1, the research is focused, in part, on scrutinising the definition of “space activity”, shedding light on which specific activities are seen as space exploration and use within the national context.

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<sup>9</sup> United Nations, 1967, “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies” (Outer Space Treaty), RES 2222 (XXI). <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

Legal recognition of astronomy and/or astronomical observations as a space activity is currently unfolding both at the international and national levels, as evidenced, for instance, by the COPUOS meetings.<sup>10</sup> For national space laws and policies that include a definition for space activity, the debate focuses on whether astronomical observations are or can be included in those definitions.

This research finds that there is a lack of clarity regarding the nature of astronomical observations within the primary national space laws and policies of each country that was examined, as applicable. In several countries, the definition of space activity does not explicitly designate astronomy or astronomical observations as a space activity *per se*. This scope does not intrinsically exclude astronomical observations from being categorised as such.<sup>11</sup> Consequently, through a legal interpretation of the term space activity, there exists potential recognition of astronomical observations as a legitimate type of space activity. Moreover, in certain cases, astronomy and its advancement are primarily associated with the use of space for terrestrial applications via technologies like satellites, such as in Chile.<sup>12</sup> This country, which does not yet have a national space policy as such in place, incorporates astronomy into other existing policies such as defence and science, particularly in the context of Earth observation, data collection from space for purposes that include monitoring, defence, border control, communication, military functions, and state security.

Conversely, for some nations, such as in the case of Azerbaijan,<sup>13</sup> space activity is strictly defined as an activity associated with space objects, restricting the scope of space activity to this specific domain. Limiting the domain to space objects, may prohibit categorization of astronomical observations as a space activity.

**Summary:** In several countries, space laws and policies do not necessarily designate astronomy or astronomical observations as space activity. Nevertheless, this does not intrinsically exclude astronomical observations from being categorised as such.

### ***3.2 Does the legal recognition of astronomical observations and/or astronomy as a form of exploration and use of outer space serve as a requisite for protecting D&QS?***

Although the legal recognition of “astronomy” and/or “astronomical observations” as a space activity could offer substantial protection for D&QS, obtaining this recognition requires collective efforts from different actors and from various jurisdictions, and it may not be the most efficient or effective way to achieve D&QS protection in the short to medium term. It could also be time-consuming, especially at

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<sup>10</sup> See, for instance, A/AC.105/C.1/2023/CRP.18/Rev.1. United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). Conference Room Paper on the Protection of Dark and Quiet Skies for science and society. 15 February 2023; available online:

[https://www.unoosa.org/res/oosadoc/data/documents/2023/aac\\_105c\\_12023crp/aac\\_105c\\_12023crp\\_18rev\\_1\\_0\\_html/AC105\\_C1\\_2023\\_CRP18Rev01E.pdf](https://www.unoosa.org/res/oosadoc/data/documents/2023/aac_105c_12023crp/aac_105c_12023crp_18rev_1_0_html/AC105_C1_2023_CRP18Rev01E.pdf)

<sup>11</sup> Law of the Russian Federation of 20.08.1993 N 5663-1 On space activities; available online:

<http://pravo.gov.ru/proxy/ips/?docbody=&nd=102025742>.

<sup>12</sup> Chile National Defence Policy 2020; available online:

<http://163.247.42.118/transparencia/POLDEF/POLDEF2020/POLDEF2020.pdf>; National Science, Technology, Knowledge and Innovation Policy (2020-2022); available online:

[https://www.minciencia.gob.cl/politicactci/documentos/Politica-Nacional-CTCi\\_Chile-2020.pdf](https://www.minciencia.gob.cl/politicactci/documentos/Politica-Nacional-CTCi_Chile-2020.pdf); Action Plan - National Science, Technology, Knowledge and Innovation Policy (2020-2022); available online:

[https://www.minciencia.gob.cl/politicactci/documentos/Politica-Nacional-CTCI\\_Plan\\_Accion\\_Chile\\_2020.pdf](https://www.minciencia.gob.cl/politicactci/documentos/Politica-Nacional-CTCI_Plan_Accion_Chile_2020.pdf).

<sup>13</sup> Law of the Republic of Azerbaijan on space activities of 4 August 2023; available online:

<https://president.az/az/articles/view/60774>.

the international level, depending on the approach. Consequently, in parallel with longer-term efforts or as a separate approach, alternative legal instruments from various fields, such as environmental protection laws or light pollution mitigation regulations, could play a crucial role in reducing both forms of light pollution (terrestrial and orbital) and upholding the protection of D&QS for astronomical observations. Leveraging pre-existing legal frameworks becomes a necessary strategy for addressing this issue, with the examined states showing varying perspectives on its implementation.

**Summary:** Although the legal recognition of astronomy and/or astronomical observations as a space activity could offer significant protection for D&QS, this may not be the most efficient or effective way in the short to medium term. Using pre-existing legal frameworks such as environmental protection laws or light pollution mitigation regulations could be a feasible option in this respect.

### **3.3 Do countries have norms aiming for the protection of dark and quiet skies for astronomical observations?**

Certain countries have implemented legal frameworks and regulations aimed at protecting D&QS for astronomical observations. Notable examples include (1) Spain, which has enacted The Law on Protection of the Astronomical Quality of the Observatories of the Institute of Astrophysics of the Canary Islands<sup>14</sup> to preserve the sky for astronomical facilities on La Palma and Tenerife; (2) France, which has passed a Decree for the protection of exceptional astronomical observing sites;<sup>15</sup> (3) and the city of Saint-Petersburg of the Russian Federation, which has adopted a local regulation on the protection of D&QS above the Central Astronomical Observatory of the Russian Academy of Sciences in Pulkovo, again for astronomical observations.<sup>16</sup> Notably, the majority of these regulations are predominantly found at the local or regional levels, particularly in the vicinity of observatories. A long-standing approach to ensure the preservation of D&QS, at least for terrestrial-based light pollution, includes the establishment of protection zones, including dark or quiet areas, within which light or radio emissions are limited. This specific practice cannot be extended to orbital light pollution.

Additionally, many of the analysed countries (Bulgaria, Chile, Dominican Republic, Peru, Slovakia, Spain, and South Africa, among others) have initiated national conversations on the necessity to protect D&QS for astronomical observations, following the discussions within COPUOS.<sup>17</sup> It is crucial to

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<sup>14</sup> Spain, 1988, Law 31/1988 on the Protection of the Astronomical Quality of the Observatories of the Institute of Astrophysics of the Canary Islands of 31 October 1988. <https://www.boe.es/eli/es/l/1988/10/31/31>

<sup>15</sup> France, 2018a, Decree on the prevention, reduction and limitation of light pollution. <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000037864346>

<sup>16</sup> Soviet Union, 1945, The Council of People's Commissioners of the USSR Order dated March 11, 1945 N 4003r. <https://www.derev-grad.ru/zakon-stroitelstvo/zakonodatelstvo-o-stroitelstve-sssr4/rasporyazhenie-snk-sssr-ot-11-03-1945--4003r-o-vostanovleni.pdf>; Russian Scientific Council, 2015, Regulations on the astroclimate: Scientific Council of the Russian Academy of Sciences Rules for making decisions on the coordination of economic and construction activities in the protective park zone of the observatory 2015. <http://puldb.ru/ac/docs/2015-12-25%20reglament.pdf>

<sup>17</sup> United Nations Committee on the Peaceful Uses of Outer Space, 2023, General exchange of views on dark and quiet skies for science and society, A/AC.105/C.1/2023/CRP.18/Rev.1, COPUOS, STSC, 6-17 February 2022, Item 17.

emphasise that the current status of the protection of D&QS in many states primarily revolves around discussions rather than the existence of concrete, formalised documents.

In this context, there is a growing trend in the adoption of laws aimed at reducing terrestrial light pollution across the globe (e.g., Chile, Croatia, Czech Republic, Italy, Japan, Oman, Spain, USA).<sup>18</sup> These legal measures span various regulatory fields, encompassing urban planning and environmental conservation, rather than being exclusively dedicated to the protection of astronomical observations. Nevertheless, these laws have the ancillary effect of reducing ALAN levels and benefiting astronomy. Furthermore, these local and regional efforts do have relevance for orbital light pollution, as they can, in principle, help raise awareness of satellite light pollution by reconnecting people with the night sky, something many have already lost.

As for the protection of quiet skies from radio interference, the situation differs. While regulations on light pollution mitigation started to develop rapidly due to increased concerns about its adverse impacts on astronomy, the environment and energy consumption, protection of radio astronomy has not received the same level of attention. Only a few countries, such as the USA and Russia, enacted norms to protect quiet skies for radio astronomical activities by major observatories. In particular, the Federal Communications Commission (FCC) established the United States National Radio Quiet Zone, which includes the Green Bank Observatory.<sup>19</sup> To minimize interference with scientific research, this area restricts radio frequency usage. As for orbital radio interference, no specific requirements and limitations were identified. Further regulatory advancements are needed to ensure adequate protection of quiet skies from ground-based and orbital harmful interference.

**Summary:** Some countries have initiated national conversations on the necessity to protect D&QS for astronomical observations, while others have already implemented such legal frameworks and regulations (such as Spain, France, and the city of Saint-Petersburg of the Russian Federation). This trend is, however, limited. Most of the current national regulations have defined legal measures to reduce terrestrial light pollution (e.g., Chile, Croatia, Czech Republic, Italy, Japan, Oman, Spain, USA, etc.), rather than adopted norms to address orbital interference. As for the protection of quiet skies from harmful interference, regulations in this regard are very limited and underdeveloped.

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[https://www.unoosa.org/res/oosadoc/data/documents/2023/aac\\_105c\\_12023crp/aac\\_105c\\_12023crp\\_18rev\\_1\\_0\\_html/AC105\\_C1\\_2023\\_CRP18Rev01E.pdf](https://www.unoosa.org/res/oosadoc/data/documents/2023/aac_105c_12023crp/aac_105c_12023crp_18rev_1_0_html/AC105_C1_2023_CRP18Rev01E.pdf)

<sup>18</sup> Examples: Chile, 2023b, New Lighting Standard (2023).

<https://www.diariooficial.interior.gob.cl/publicaciones/2023/10/18/43679/01/2391423.pdf>; Croatia, 2019, Act NN 14/2019 on Protection against Light Pollution. [https://narodne-novine.nn.hr/clanci/sluzbeni/2019\\_02\\_14\\_271.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2019_02_14_271.html); France, 2018a, Decree on the prevention, reduction and limitation of light pollution. <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000037864346>

<sup>19</sup> (USA) Federal Communications Commission (FCC) in Docket No. 11745 (November 19, 1958) and by the Interdepartment Radio Advisory Committee (IRAC) in Document 3867/2 (March 26, 1958); available online: [https://www.gb.nrao.edu/nrqz/FCC\\_Docket\\_11745\\_NRQZ.pdf](https://www.gb.nrao.edu/nrqz/FCC_Docket_11745_NRQZ.pdf)

### **3.4. Is there any country with a regulatory framework for protecting D&QS that could potentially be used as a model for other countries?**

No singular “best approach” or model law has so far been identified during this research, nor is there an expectation to find one, as regulatory approaches vary significantly and are based on their unique national contexts. Since many of the national laws and policies to address terrestrial light pollution have only recently been enacted, it is premature to assess their implementation or their potential to reduce ALAN. Additional assessments, including accurate measurements of, for example, night sky brightness and constant monitoring of light pollution, will be essential for determining which legislation is effective in this regard. Regulations on limiting harmful orbital interference are even more limited.

Although a model framework may not presently exist, there is a discernible trend where countries scrutinise the regulations of other countries while formulating their own regulatory frameworks and policies. If a particular country enacts an exceptionally effective law, it would be advantageous for the astronomical community to proactively share this example with other states and stakeholders.

**Summary:** No singular “best approach” or model law was identified during this research. Although some approaches can present some similarities to some extent, each of them is unique as it responds to national expectations and needs.

### **3.5 Are there any other laws applicable to protect D&QS?**

Among existing national regulatory frameworks, the primary area of legislation for protecting D&QS appears to be environmental law. Within the realm of environmental protection, most countries provide a definition of “pollution” that incorporates “energy” as a pollutant and implies various principles such as the precautionary principle and prevention principle. Certain countries, like Germany,<sup>20</sup> have amended their general environmental law to include provisions for reducing environmental impacts associated with terrestrial light pollution, which will potentially benefit astronomical observations. Other examples include France and Kazakhstan,<sup>21</sup> which have also taken measures to reduce nighttime brightness. Other regulatory fields that may be helpful in promoting D&QS include space law (e.g., space sustainability, space debris mitigation) and laws on protection of cultural heritage, as well as certain provisions of urban planning and building laws.

**Summary:** Among existing national regulatory frameworks, the primary area of legislation for protecting D&QS appears to be environmental law, together with space law (e.g., space sustainability, space debris mitigation), laws on protection of cultural heritage, and certain provisions of urban planning and building laws.

### **3.6 Is light pollution a form of pollution under the national environmental law?**

Based on the analysis of various national jurisdictions, at this time, classifying light pollution as a form of pollution can occur mainly through one of two means. On one hand, it may be inferred through an

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<sup>20</sup> The Federal Nature Conservation Act (Germany); available online: [https://www.gesetze-im-internet.de/bnatschg\\_2009/](https://www.gesetze-im-internet.de/bnatschg_2009/)

<sup>21</sup> See, for instance, Decree on the prevention, reduction and limitation of light pollution (France); available online: <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000037864346>; Environmental Code of the Republic of Kazakhstan; available online: [https://online.zakon.kz/Document/?doc\\_id=39768520#pos=634;-86.33332824707031](https://online.zakon.kz/Document/?doc_id=39768520#pos=634;-86.33332824707031).

interpretation of national environmental laws that include “energy pollution” as a broader term, encompassing the effects of light pollution (e.g., Slovakia, Poland, Russian Federation, Bulgaria, and China). On the other hand, some other countries, such as Croatia, Germany, France, Spain, and Slovenia, directly identify light pollution as a form of pollution or identify light/ALAN as a pollutant within their environmental legislation.

**Summary:** Light pollution can be seen as a form of pollution by interpreting national environmental laws and including “energy pollution” as a broader term, or by identifying light pollution as a form of pollution or light/ALAN as a pollutant within environmental legislation.

### ***3.7 Do countries have initiatives to protect dark and quiet skies?***

In addition to reviewing regulatory frameworks, initiatives in various countries were also identified during the research process. Although such initiatives do not constitute legislation, they could contribute to regulatory changes that protect D&QS.

Most countries under consideration have growing or emerging local and national initiatives designed to promote the preservation of night skies from different perspectives. These initiatives encompass astro-tourism, environmental conservation, and the advancement of astronomical observations. The list of countries with such initiatives includes, but is not limited to, Chile, Ecuador, Brazil, Japan, Poland, Costa Rica, the United Arab Emirates, New Zealand, Colombia, Australia, several African nations, Canada, and the United States, among others.

**Summary:** Countries do have D&QS initiatives, and although such initiatives do not constitute legislation, they could lead to regulatory amendments. These initiatives encompass astro-tourism, environmental conservation, and the advancement of astronomical observations.

### ***3.8. Do countries have developed regulations and/or technical requirements for satellites that can be beneficial for the protection of D&QS?***

The research indicates that regulations concerning satellites are largely underdeveloped in most jurisdictions and lack specific requirements relevant to the protection of D&QS. In countries with relatively more advanced satellite legislation, such as Russia, China, and the United States – where comprehensive regulations cover authorization, licensing, and registration processes – satellite operators are typically not obligated to disclose or provide detailed information on the technical specifications of satellites. Measures to reduce satellite light pollution, such as special non-reflective coating, are also insufficiently developed and are provided in non-binding guidelines and recommendations.

**Summary:** Currently, the national legislation on satellites is underdeveloped in most jurisdictions and does not directly provide for any measures to reduce the impacts of satellites on astronomical observations.

#### 4. National examples

The above sections summarise the results of the national analysis in aggregate. Here, brief descriptions are given of select national laws and regulations that address specific aspects of the protection of D&QS for astronomical observations.

In Chile, the *Nueva Norma Lumínica (New Lighting Standard) D.S. No1/2022 MMA*,<sup>22</sup> approved in October 2023, represents a significant step in reducing terrestrial light pollution nationwide. It extends the regulation established by Decree 43 from 2014 to cover the entire country, introducing new technical requirements and emphasising protection for biodiversity and human health.

The Czech Republic amended the *Act of the Czech National Council on Nature and Landscape Protection* in [2017](#) to address light pollution in national parks. Additionally, light pollution has been considered in Environmental Impact Assessments since [2020](#), and the Ministry of the Environment updated its public lighting recommendations in [2021](#).

South Africa has legislation focused on protecting astronomy from ground-based light pollution and radio interference, though it does not specifically address interference from space objects.<sup>23</sup>

The United Kingdom stands out for its *Clean Neighbourhoods and Environment Act of 2005*<sup>24</sup> and the *Society of Light and Lighting (SLL) Code for Lighting 2022*,<sup>25</sup> which enable individuals with a ‘professional interest’ in dark skies, including optical astronomers, to take action against ‘sky glow’ interference. However, case resolutions remain uncertain and are determined on a case-by-case basis.

The examples above are a small sample of the different ways national legislation is used to address issues related to the protection of D&QS. However, local jurisdictions often impose stricter rules to protect local astronomical and environmental assets. For example, in Spain, stringent local laws supplement limited national laws<sup>26</sup> to protect the Canary Islands' international astronomical observatories. Similarly, in New Zealand, local ordinances<sup>27</sup> designate the area around Lake Tekapo as a dark sky reserve for astro-tourism, benefiting both amateur astronomers and tourism operators, while preserving Mt. John's professional observatories. The full national analyses (Yakushina et al. 2024) have further information on all countries included in the study.

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<sup>22</sup> Chile, 2023a, Decree 43 of the Ministry of the Environment of Chile. <https://www.bcn.cl/leychile/navegar?idNorma=1050704>; New Lighting Standard (2023). <https://www.diariooficial.interior.gob.cl/publicaciones/2023/10/18/43679/01/2391423.pdf>

<sup>23</sup> South Africa, 2007, Act on Astronomy Geographic Advantage 21 of 2007. <https://www.gov.za/documents/astronomy-geographic-advantage-act>

<sup>24</sup> United Kingdom, 2005, Clean Neighbourhoods and Environment Act 2005 c. 16, Part 9, Statutory Nuisance, Section 102. <https://www.legislation.gov.uk/ukpga/2005/16/section/102>

<sup>25</sup> The SLL Code for Lighting (London, 2022), [www.cibse.org](http://www.cibse.org), 1.4.4.

<sup>26</sup> Law 34/2007, of November 15, on Air Quality and Protection of the Atmosphere (Spain); available online: <https://www.boe.es/eli/es/l/2007/11/15/34/con>

<sup>27</sup> New Zealand, 2022, Lighting Restrictions for the Mackenzie District to protect the Aoraki Mackenzie International Dark Sky Reserve. [https://www.mackenzie.govt.nz/\\_data/assets/pdf\\_file/0007/677959/Light.pdf](https://www.mackenzie.govt.nz/_data/assets/pdf_file/0007/677959/Light.pdf)

## 5. Further research

Further research is needed to provide a more comprehensive analysis of the overarching national frameworks available for protecting dark and quiet skies. Particular attention is needed toward addressing satellite interference with radio astronomy (i.e., protection of “quiet skies”). In addition, a more in-depth investigation into national regulations governing satellites will be needed, as well as a broader assessment of satellite impacts on the environment, including the space environment. Further analysis should also include an examination of various initiatives and practices in place for addressing the preservation of D&QS for purposes other than astronomical observations.

## INTERNATIONAL ANALYSIS

This section summarizes the WP2WG analysis of international law and policies relevant to the protection D&QS. There is some inherent complexity in the international governance of outer space arising from varying interpretations of key treaties, such as the OST,<sup>28</sup> and the roles of international fora, such as the UN COPUOS, in promoting coordination and cooperation among states. Emerging from this complexity is a need to consider alternative avenues, alongside established mechanisms, to make progress on timescales that match the rapid industrialization of space.

Some of the primary questions addressed in the international analysis include whether astronomical observations should be interpreted as an exercise in the “exploration and use” of outer space under the OST and if not, whether their inherent need to access outer space still provides protections under the OST.

Another question concerns whether there is potential for the International Telecommunication Union (ITU) to aid in mitigating orbital light pollution, in addition to serving its critical role in managing the radio frequency spectrum. Germane to this is the discussion around whether orbital allocations in LEO are possible and whether this too could be done primarily through the ITU.

Environmental principles are also brought into the space context, with a focus on orbital light pollution and the application of the no-harm rule, as well as the precautionary principle in environmental protection. These considerations are essential to understanding and addressing the environmental impacts of space activities.

Liability issues, particularly in the context of satellite constellations, are examined to understand how these activities fit into the liability regime established by the OST and the Liability Convention,<sup>29</sup> especially regarding the concept of “damage”.

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<sup>28</sup> OST(1967) (OST) United Nations 1967, “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies” (Outer Space Treaty), RES 2222 (XXI), 1966. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

<sup>29</sup> Liability Convention (1972) (Liability Convention) United Nations 1972, “Convention on International Liability for Damage Caused by Space Objects”, RES 2777 (XXIV), 1971. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introliability-convention.html>



The work has shown how the evolving nature of space law necessitates the involvement of multiple international institutions and legal instruments. This section delves into some of the identified gaps in international law and policy, lessons learned, and possible avenues for the protection of D&QS.

## **1. Identified gaps**

### ***1.1. Legal classification of astronomy***

States have yet to make a clear position regarding the legal status of astronomy within international law. This is arguably because it simply has not mattered before. However, now that other forms of the exploration and use of outer space (e.g., satellite communications and exploration spacecraft) are poised to cause substantial interference with ground-based astronomical observations, the question of legal status matters for understanding whether there already exists an obligation for satellite launching states to show "due regard" and to avoid "potentially harmful interference" with the activities of states that are conducting astronomical observations under Article IX, OST. Having a widely agreed position on this issue further helps to identify paths toward resolving any corresponding interference, across the electromagnetic spectrum, between activities. Studies show through policy analyses<sup>30</sup> and a treaty interpretation of the OST<sup>31</sup> that astronomical observations are a form of exploration of outer space under international law. Other WP2WG members, while stopping short of this conclusion, do find merit in the interpretation that the legal provisions of the OST, particularly Article IX, apply to protecting astronomical observations.

Nonetheless, a gap remains, which suggests that there is a need for a dedicated effort to clarify the legal status of astronomical observations, as well as the duty of states to show due regard toward astronomical observations.

Such an effort could involve the exploration of various legal frameworks, including environmental law, heritage protection, and space law, to identify where and how astronomy best fits.

Establishing legal obligations of states toward those which conduct astronomical observations could pave the way for more targeted and effective policies and regulations, both at the national and international levels, to safeguard D&QS for astronomical research and humanity.

### ***1.2. Environmental principles in space law***

The integration of environmental principles into space law, particularly in relation to light and radio pollution, is an area that remains underdeveloped. While terrestrial environmental law has evolved significantly in recent decades, space law has lagged in incorporating these principles effectively. There are visible steps towards addressing these issues, such as the adoption of the Guidelines for the Long-

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<sup>30</sup> G. Rotola and A. Williams 2021, "Regulatory Context of Conflicting Uses of Outer Space: Astronomy and Satellite Constellations", *Air and Space Law*, 46, 4/5, 545-568. <https://doi.org/10.54648/aila2021031>

<sup>31</sup> M.Byers and A.Boley 2023, *Who Owns Outer Space? International Law, Astrophysics, and the Sustainable Development of Space*, Cambridge University Press. <https://doi.org/10.1017/9781108597135>

Term Sustainability of Outer Space Activities,<sup>32</sup> Planetary Protection Policies,<sup>33</sup> and the principles embedded in Article IX of the OST. However, these measures are simply not enough. Issues such as space debris have received increasing attention, but the impact of human activities in space on the astronomical environment is inadequately covered. The challenge is not only pollution from debris or atmospheric alteration but also orbital light and radio interference, which can significantly hinder astronomical observations.

Addressing this gap requires a concerted effort to develop and integrate environmental principles specifically tailored to the space context. This could involve the creation of new legal instruments or the adaptation of existing ones, taking into account the unique characteristics of space activities and their impact on astronomy. Such principles should aim to ensure sustainable use of space and minimize harmful interference, thereby protecting the interests of the global astronomical community.

### **1.3. Role of ITU and resource management**

The International Telecommunication Union (ITU) has a well-established role in managing the radio frequency spectrum, but is facing new and complex challenges in managing spectrum as ever greater allocations are demanded for space assets. Associated with this is the sheer number of satellites being filed, with multiple countries filing for thousands to hundreds of thousands of satellite slots, in many cases with no clear plan or intent to utilize those reservations.<sup>34</sup> This practice expands the uncertainty associated with the near-future orbital density and the steps most needed to address the looming problem.

Yet, even for the satellites that are plausibly expected to be launched, concerns about orbital overcrowding remain. This exacerbates light and spectrum pollution issues while further raising the risk of space debris and collisions. There is thus a pressing need for the ITU or the international community to develop mechanisms to understand when orbits are becoming too crowded and to potentially limit filings for new satellite constellations based on this information. The ITU is expected to have a role in this process, whether through regulation, its study groups, or both.

In addition to addressing radio spectrum concerns, there has been discussion about whether the ITU could also play a role in orbital light pollution regulation. Light pollution, like radio frequency interference, has the potential to be a substantial threat to astronomical observations and it is part of the electromagnetic spectrum. However, light pollution and its consequences have so far been interpreted as lying outside the ITU's mandate.

Expanding the mandate of the ITU, at least in some way, to include the management of light pollution, as well as addressing the issue of orbital overcrowding in the LEO region, could be a significant step forward. This could involve examining the feasibility and implications of such an expansion, including the technical, legal, and political aspects, and could be part of a broader space sustainability initiative.

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<sup>32</sup> LTS (2019) (LTS Guidelines) United Nations 2019, "Guidelines for the Long-term Sustainability of Outer Space Activities", Report of the Committee on the Peaceful Uses of Outer Space, Annex II, A/74/20. [https://www.unoosa.org/oosa/en/oosadoc/data/documents/2019/a/a7420\\_0.html](https://www.unoosa.org/oosa/en/oosadoc/data/documents/2019/a/a7420_0.html)

<sup>33</sup> COSPAR (2021). Committee on Space Research 2021, "COSPAR Policy on Planetary Protection", COSPAR Bureau, 3 June 2021. [https://cosparhq.cnes.fr/assets/uploads/2021/07/PPPPolicy\\_2021\\_3-June.pdf](https://cosparhq.cnes.fr/assets/uploads/2021/07/PPPPolicy_2021_3-June.pdf)

<sup>34</sup> A. Falle, E. Wright, A. Boley, and M. Byers 2023, "One million (paper) satellites", Science, 382,150-152. <https://www.science.org/doi/10.1126/science.adi4639>

Moreover, some action could be taken through ITU study groups without, at this time, creating any reorganization or expansion of the ITU's mandate. Overall, the ITU's experience and expertise in managing finite resources in outer space, specifically the radio spectrum for satellites and geosynchronous orbits, could provide valuable insights into how similar principles and practices could be applied to the management of light pollution and LEO. Such a development would not only help to protect the astronomical environment, but would also contribute to the sustainable and responsible use of outer space.

## **2. Lessons learned**

### ***2.1. Beyond Article IX of the Outer Space Treaty***

Regardless of how states view astronomical observations vis-à-vis international law, Article IX of the OST is sufficiently broad that the analysis team found that it may create obligations for states to safeguard astronomical interests. In particular, the article establishes the principle that states must show "due regard" toward the interests of other states in the exploration of outer space. It further prohibits "harmful interference" with the peaceful use and exploration of outer space by states, as well as expresses a requirement for states to seek international consultations in cases of known possible interference. Along with Article I of the OST, these obligations establish general principles of coordination and cooperation and recognize that there is a diverse set of activities that are used to carry out state interests in outer space.

With this in mind, using Article IX of the OST should not be the only legal avenue pursued. While the provision is significant, its broad language and the interpretative flexibility it offers can lead to varied implementations, which may not always align with the specific needs of protecting astronomical environments.

For this reason, Article IX can be seen as offering a foundation for environmentally motivated solutions, highlighting the importance of protecting the space environment for safe and equitable access to outer space, as well as its peaceful exploration and use. Much more effort is needed to identify actionable paths forward on this point.

Looking beyond these legal interpretations opens up further possibilities. For instance, framing astronomical observations within the context of environmental protection or cultural heritage could offer new perspectives and legal avenues. This approach could lead to the development of specific guidelines or treaties tailored to the preservation of D&QS. It also encourages looking at space law not just in isolation but in conjunction with other areas of international law, thereby fostering a more holistic approach to the governance of space activities. Furthermore, it naturally brings in moral and ethical questions concerning the alteration of the environment, especially when those alterations are driven by a few states and impact all states and peoples.

### ***2.2. Liability and political strategy***

The concept of liability in space law has the potential to be a strong mechanism for enforcing good norms of behaviour in the exploration and use of outer space, particularly with its provision of "absolute

liability" (not fault-based) for damages that occur on the ground, at sea, or in aeroplanes in flight. However, liability of space activities in the context of damage caused by pollution is a complex issue under the Liability Convention, where "damage" means "loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organization". Applying light or spectrum pollution under this definition is limited, if possible at all. For example, whether there is a way to include damage to the sky under the concept of the property of a juridical person remains to be seen but does not appear to be tenable at this time.

One possible way forward, however, is to consider the damage to observational data, which are widely recognized to be a form of property and can be plausibly damaged as a result of another state's activities in outer space. Yet, even with this, a potential limitation is that the Liability Convention does not offer a clear way to incorporate cumulative effects that, while leading to considerable damage, are not attributable to a single event. Moreover, even with a plausible definition of damage, states may not spend the political capital needed to invoke the Liability Convention over something such as data loss.

In summary, while the concept of liability for space-related activities could be interpreted to offer some protection against the impacts of satellite constellations, this is not straightforward. The current legal definitions and frameworks make it a less feasible avenue for addressing these broader concerns.

However, just as political concerns could limit action by some states, others could effectively wield the threat of invoking the Liability Convention as a tool, serving as a form of leverage in international negotiations. It is further a way to drive home the urgency of establishing meaningful regulations to protect D&QS. By highlighting the potential risks and liabilities, states and organizations can be motivated to adopt more responsible practices. This approach can also be instrumental in advocating for the development of new norms and guidelines that address the specific needs of dark and quiet skies, thus indirectly influencing the legal landscape in favour of astronomical conservations.

### ***2.3. Simultaneous national and international focus***

The analysis of international law and policy highlights the importance of addressing astronomical conservation through both national and international channels. Nationally, countries could implement specific regulations and policies that would directly protect D&QS, tailored to their unique geographical (e.g., dark sky reserves) and socio-political contexts. These national actions could serve as models or catalysts for international initiatives, demonstrating practical methods for mitigating light and radio spectrum pollution.

Internationally, the challenge lies in harmonizing these diverse national approaches and elevating them to a global platform to achieve a common outcome, whether through international standards, agreements, or some other process. This harmonization is particularly important in recognizing and legitimizing astronomical observations as a form of exploration of outer space or otherwise providing protections. Furthermore, it is crucial in providing mechanisms for the protection of the space environment and the assessment of the impact of satellite and other space activities. Such international collaboration could lead to a clearer understanding of the aggregate impacts of satellite activities and pave the way for global solutions for space environmental protection.

The goal is to develop international standards or agreements that encapsulate the collective interests and responsibilities of all states in preserving the astronomical environment. This includes not only recognizing astronomy as a valuable and integral way to explore space, but also instituting effective measures for environmental protection, creating a cohesive framework that acknowledges the importance of astronomy and actively works towards minimizing the adverse effects of space activities on the astronomical environment.

### **3. Future steps**

#### ***3.1. Enhanced international dialogue***

Regular and meaningful dialogue among countries is crucial for recognizing and prioritizing the value of astronomy and astronomical observations. This dialogue should be multifaceted, involving not just space agencies and governments, but also satellite operators, international organizations, scientific communities, and civil society. The aim is to foster a global understanding of the importance of astronomy and the threats it faces from light and radio pollution. International conferences, symposiums, and working groups could be key platforms for these discussions.

Part of this dialogue involves understanding how to effectively utilize existing international fora, such as COPUOS, while also recognizing their limitations. For instance, COPUOS primarily allows for state representation, which excludes other crucial stakeholders in the astronomy community. Therefore, while leveraging such platforms, there is also a need to create new, more inclusive ones, much like what was achieved during events like the SATCON and D&QS conferences.<sup>35</sup> Establishing new platforms in a more institutionalized way could facilitate a comprehensive and inclusive approach to addressing astronomical conservation.

Part of this dialogue should also focus on developing a shared vision and commitment to protecting D&QS.<sup>36</sup> This can be achieved through the creation of international agreements or treaties specifically dedicated to this cause, or by incorporating these issues into existing international space governance frameworks. Such efforts would also benefit from the inclusion of educational and public awareness campaigns to broaden the understanding and support for astronomical conservation at all levels.

#### ***3.2. Expanding legal interpretations***

To accommodate the unique requirements of astronomy, there could be a need to explore broader interpretations and applications of existing law and policy. This could involve (re)analyzing existing

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<sup>35</sup> SATCON2 (2021). SATCON2 Working Group Reports 2021, NSF NOIRLab. <https://baas.aas.org/report-of-the-satcon2-workshop-1216-july-2021>; DQSII (2021). Dark and Quiet Skies II Working Group Reports 2021, IAU, UNOOSA, Spain & NSF NOIRLab. <https://doi.org/10.5281/zenodo.5874725>

<sup>36</sup> The WP2WG team acknowledges the important step in this regard of the inclusion of D&QS on the COPUOS agenda. United Nations Committee on the Peaceful Uses of Outer Space, A/AC.105/C.1/2023/CRP.18/Rev.1. Conference Room Paper on the Protection of Dark and Quiet Skies for science and society. 15 February 2023. [https://www.unoosa.org/res/oosadoc/data/documents/2023/aac\\_105c\\_12023crp/aac\\_105c\\_12023crp\\_18rev\\_1\\_0\\_html/AC105\\_C1\\_2023\\_CRP18Rev01E.pdf](https://www.unoosa.org/res/oosadoc/data/documents/2023/aac_105c_12023crp/aac_105c_12023crp_18rev_1_0_html/AC105_C1_2023_CRP18Rev01E.pdf)

treaties and agreements under the context of the rapidly expanding access to outer space and all the activities and environmental changes that such expansion produces. This may reveal additional options under existing law that are applicable to D&QS that have so far been missed, as well as what needs to be adapted or expanded. For instance, an innovative interpretation of the OST's principles in the context of environmental protection and sustainability could provide clarity on legal avenues for safeguarding astronomical interests. A prominent example is generally clarifying concepts such as "due regard".

Such an approach should further involve the exploration of new legal concepts and frameworks that could be specifically designed for astronomical protection. This could include the development of guidelines or protocols for space operations that minimize light and radio pollution under various conditions.

### ***3.3. Diversifying strategies***

In addition to enhancing international dialogue and expanding legal interpretations, there is an urgent need to diversify the approaches for the protection of the dark and quiet sky. While the use of international space law remains critical, its limitations are evident.

By incorporating environmental protection strategies, the focus can be extended to include not only space activities but also their impact on both the space and terrestrial environments. Heritage conservation can play a role in highlighting the cultural and scientific value of the night sky, thus fostering a broader appreciation and motivation for its protection.

Liability frameworks or the threat of their use can be leveraged to hold entities accountable for activities that cause harmful interference with astronomical observations. The creation of public awareness campaigns is essential to increase the general understanding of the importance of dark and quiet skies, thereby garnering public support for protective measures.

Additionally, defining space environmental metrics such as orbital capacity and seeking space environment protections under bodies such as the ITU could be an important step in managing the increasing number of satellites and reducing the potential for light pollution and radio interference. This approach would require a comprehensive assessment of orbital use and the development of guidelines or regulations to ensure sustainable and responsible activities in space.

By exploring these diverse approaches in parallel to traditional space law discussions, a more robust and effective strategy can be developed for the protection of dark and quiet skies, aiming to create a holistic framework that encompasses various aspects of space activities and their impacts, ensuring the long-term sustainability and accessibility of space for astronomical purposes, as well as humanity.

# Recommendations

## **Incorporate the protection of dark and quiet skies into broader environmental concerns**

1. The pollution of dark and radio-quiet skies is just one issue associated with the proliferation of objects in Earth orbit, including megaconstellations.
2. Part of this incorporation should be a shift away from only space sustainability to a more inclusive Earth-Space sustainability.
3. There are many opportunities for fostering this incorporation, including through developing a common template for discussing Earth-Space sustainability, such as symbolism for casualty risks, launch pollution, reentry pollution, space debris, and dark and quiet skies.
4. This incorporation can be done at national and international levels simultaneously, each informing each other within multilateral fora. Local levels could also play a role in this incorporation, particularly through raising general awareness.
5. Momentum can be built upon recent advances in Earth-Space sustainability discussions, such as national or agency-level initiatives.
6. These broader discussions should include recognition of and information concerning cumulative impacts.
7. Recognition of natural and cultural heritage, including intangible heritage, could further be included in Earth-Space sustainability dialogue.

## **Work toward clarification of national and international law that pertains to dark and quiet skies**

1. Further analysis of existing national and international laws and policies alone is not expected to reveal new findings.
2. Effort should instead be put toward clarification of law and policies within national and international fora.
3. Examples corresponding to national law include, but are not limited to:
  - a. Establishing clear national views of the role of astronomy and astronomical observations in a nation's space policy, as well as other relevant policies, strategies, and programs.
  - b. Recognizing orbital light and radio pollution as a form of pollution.
  - c. Supporting regulatory and policy changes aiming to address terrestrial light and radio pollution.
  - d. Clarifying the meaning of "due regard" under national law and obligations of states of non-interference to corresponding interests of other states in the exploration and use of outer space.
4. Examples for international law include, but are not limited to:
  - a. Clarifying the meaning of "due regard" under the Outer Space Treaty.
  - b. Recognizing astronomical observation as an exercise of the exploration and use of outer space.
  - c. Clarifying the applicability of liability principles to direct and indirect damages caused by orbital light pollution.
  - d. Considering international environmental law principles in the protection of dark and quiet skies.

### **Take clear steps to involve more astronomers in actions concerning the protection of dark and quiet skies**

1. Actions can be taken by professional and amateur astronomers, as well as dark and quiet skies allies, that go well beyond formal involvement with the IAU CPS.
2. For example, astronomers could be encouraged to include a slide on dark and quiet skies in their presentations, whether professional or public.
3. Programming at parks or environmental communities could include information on the potential to change the night sky globally.
4. Steps that broadly engage with more individuals to make dark and quiet skies a recognizable issue should be pursued.
5. Identify and engage with active national and local initiatives that are already working on raising awareness, which may include recognising and supporting their actions.
6. A wide suite of educational materials should be distributed by the CPS. Building on the material already produced by the Community Engagement Hub, such materials could include lesson plans for community activities and classroom learning goals.
7. These steps could include engagement with foundations and other organizations. A non-exhaustive list includes: The International Institute of Space Law, Space Generation Advisory Council, Students for the Exploration and Development of Space, the Space Court Foundation, Secure World Foundation, Union of Concerned Scientists, Centre for Strategic and International Studies, and the Aerospace Corporation.

### **Expand efforts beyond UN COPUOS to foster protections for dark and quiet skies among international bodies**

1. UN COPUOS remains a primary body for fostering discussion between states concerning dark and quiet skies, and the recent progress toward an agenda item on this issue at COPUOS holds potential for progress.
2. However, consensus requirements at COPUOS create obstacles for making consistent progress, especially in times of geopolitical tensions in unrelated areas.
3. Several UN agencies and international organizations have missions that will be affected by the rapid industrialization of low Earth orbit, including the UN Environmental Protection Agency (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), and the International Union for the Conservation of Nature (IUCN). The International Telecommunications Union (ITU) could also play an important role beyond radio frequency spectrum allocation. These agencies are potential allies that could each enable action through different channels.
4. Possible examples include working with UNEP to pair light and spectrum pollution with measures to address the alteration of the upper atmosphere or consideration of these forms of pollutants as major environmental and biodiversity stressors.
5. UNESCO could be re-engaged to explore issuing an authoritative opinion concerning the right to access a dark and quiet sky.
6. IUCN could also provide resources and expertise for investigating whether changes due to satellites have broader conservation implications.
7. ITU could foster Earth-Space sustainability discussions through its study groups.
8. Eventually establish new institutionalized inclusive platforms and develop new fora that are more inclusive and representative of all stakeholders involved in astronomical observations and



different uses of the sky, ensuring these are not just temporary or ad-hoc but provide a stable and ongoing mechanism for discussion and decision-making.

#### **Track the evolving national legal and policy landscape**

1. The analyses presented in this work, while extensive, remain incomplete.
2. National licensing and space policies evolve rapidly, and different, relevant agencies within a national framework may have opposing or incompatible views.
3. An ongoing effort is needed to track these developments for the IAU CPS.
4. This may be accomplished through a new working group or through hiring IAU CPS policy fellows.
5. Of particular importance to informing further IAU CPS actions is to have an up-to-date view of policy vectors and opportunities to shape those vectors

#### **Shift language and messaging to that of fulfilling obligations rather than creating new ones only**

1. The initial position paper of the IAU CPS calls on states to “obligate satellite operators to assess the impact of their system on astronomy”.
2. However, this is a weaker position than what could be adopted, as it does not reflect the potential constraints that already exist.
3. Language should, instead, call on states to meet their existing international obligations with respect to “due regard” and “non-interference” and further call on states to remove exclusions, waivers, or other mechanisms that have historically been used to avoid conducting environmental impact assessments, including orbital light and radio-spectrum pollution.

**The following annexes represent contributions and thoughts by members of the WP2 team and supplement the ideas discussed above. Their inclusion is not intended to represent a consensus view of the WP2 team. They have only been lightly edited.**

## **ANNEX A: DISCUSSION ON DUE REGARD AND CORRESPONDING INTERESTS**

**By Chris Johnson**

Please cite as C. Johnson. *Discussion on Due Regard and Corresponding Interests*, in “The National and International Landscape Concerning Dark and Quiet Skies” (Boley, Rotola, and Yakushina). IAU CPS (2024).

### **Principle of Due Regard**

Article IX of the Outer Space Treaty contains a set of binding treaty obligations. Rather than being read and applied in isolation, these provisions are interconnected obligations which support and inform each other. The first sentence speaks of actors being guided by the principles of cooperation and mutual assistance, and of showing due regard to the corresponding interests of all other State Parties in the exploration and use of outer space.

*In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty.*

Thereafter, the second sentence of Article IX creates a negative obligation (a prohibition) whereby States shall not cause harmful contamination of the space domain. The latter half of the sentence also creates a linked obligation for States to adopt, where necessary, appropriate measures to avoid such threatened harmful contamination.

*States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.*

The third and fourth sentences of Article IX then create additional obligations and rights. The third sentence stipulates that States shall, before proceeding with an activity or experiment potentially threatening harmful interference with other State’s space activities, it shall undertake appropriate international consultations.

*If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.*

Finally, the fourth sentence of Article IX creates a privilege for a State to request international consultations with other States Parties to the treaty planning space activities or experiments which they (the requesting State) have a reason to believe threaten harmful interference to their activities.

*A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.*

It should be highlighted that between sentences two and sentences three and four, Article IX contains similar sounding—yet distinct—concepts of harmful *contamination* (of the space domain), and harmful *interference* (with the activities of other States). Harmful contamination refers to a need to protect the space domain itself, whereas harmful interference refers to the space activities of other States.

Admittedly, these clauses are vague. Yet while they are vague, they are still binding. An additional quality is whether these phrases are merely aspirational in nature, or whether they necessitate concrete action. The first sentence’s phrasing “shall be guided by” appears merely aspirational in nature, so that States are required to merely “be guided by the principles of cooperation and mutual assistance”. However, the succeeding phrases are less aspirational and more implementable, using the direct phrase “shall” rather than “shall be guided by”. Thus, while remaining vague, these phrases are binding and require action.

The due regard obligation is not an aspirational obligation, as it is not phrased as “shall be guided by the principle of due regard.” Rather, the obligation is direct: States “shall conduct activities in outer space”... “with due regard to the corresponding interests...” Thus, we have a vague, yet binding and direct obligation. Helpfully, the other obligations of Article IX inform our understanding of the vague phrase ‘due regard’, and provide some larger context of what due regard means in the conduct of space activities.

Surveying these four sentences, a number of interlinked concepts arise. Relevant for the discussion of Dark and Quiet Skies are the principles of cooperation and mutual assistance; the principle of due regard to corresponding interests; the prohibition on harmful contamination of the space domain; the obligation of consultations when harmful interference is threatened; and the corresponding right (or privilege) to request consultations when potentially harmful interference is threatened.

Due regard is not *utmost* or *absolute* regard, but just what is considered the ‘due’ amount, and that amount (or quantum) is left to the States owing this regard to consider and quantify for themselves. Whatever amount or extent this is, it is certainly more than nothing: it is not *disregard*. It is a requirement to think of the other’s position as though it were your own position, and consider how you would want someone to treat you and your interests. Due regard seeks to ensure conciliation between rights belonging to different states, especially where those rights are overlapping, or even conflicting.

Succinctly, due regard “likely implies a certain standard of care” and “entails ‘a duty to cooperate, to strike the most appropriate balance between the divergent rights or obligations at stake’”.<sup>37</sup> Due regard is not a requirement for complete equality, but certainly a requirement for some considerations of equity, taking into account the shared nature of cosmopolitan existence of actors enjoying equal status under the law.

The due regard obligation found in space law exists parallel to a due regard obligation found in another instrument of international law, likewise, governing the behavior of States outside their territories. For example, articles 56 and 58 of the UN Convention on the Law of the Sea (UNCLOS) use the phrase. Article 56 (2) reads

*In exercising its rights and performing its duties under this Convention in the exclusive economic zone, the coastal State shall have due regard to the rights and duties of other States and shall act in a manner compatible with the provisions of this Convention.*

Article 58 also contains a due regard obligation in paragraph 3.

*In exercising their rights and performing their duties under this Convention in the exclusive economic zone, States shall have due regard to the rights and duties of the coastal State and shall comply with the laws and regulations adopted by the coastal State in accordance with the provisions of this Convention and other rules of international law in so far as they are not incompatible with this Part.*

Consequently, some reasoning and interpretative guidance can be found in Maritime law, and the literature on those subjects. In the Chagos case, the Arbitral Tribunal provided some descriptions on how to consider due regard, including that the ordinary meaning of due regard requires that States have regard for the rights of other states ‘as is called for by the circumstances and by the nature of those rights’, and that the extent of the regard required. Will depend upon the nature of the rights held... their importance. the extent of the anticipated impairment, and nature and importance of the activities contemplated, and the availability of the alternative approaches.” They further held that when significant rights are at stake, they are entitled to a *corresponding* degree of regard”. Also important was a determination that, in assessing the amount of regard owed “at least some consultation with the rights-holding state” is necessitated, at least in a majority of cases”. Thus, some consultation and a “balancing exercise” is warranted. Thus, while due regard in space law is an under-defined term, some guidance can be found in the terrestrial maritime realm.

### **Corresponding Interests**

The obligation of due regard requires that this regard is given to the ‘corresponding interests’ of other states in the exploration and use of outer space. It may be initially unclear what is a corresponding

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<sup>37</sup> M. Forteau 2019, “The Legal Nature and Content of ‘Due Regard’ Obligations in Recent International Case Law”, *The International Journal of Marine and Coastal Law*, 34(1):25-42 (2019), at: <http://dx.doi.org/10.1163/15718085-23341040>

interest, or what ‘corresponding’ means in this context. Professor Marchisio writes in the Cologne Commentary that<sup>38</sup>

The notion of “corresponding interests” recalls the fact that there are no unilateral interests in outer space and, as a consequence, there cannot be discriminatory treatment. Under this principle, space activities carried out by a given State should be in accordance not only with its own interests, but also with the interests and rights of the remaining States Parties to the Outer Space Treaty.

Merriam-Webster defines corresponding as “related” or “accompanying”, and “having or participating in the same relationship (such as kind, degree, position, correspondence, or function) especially with regard to the same or like wholes”.<sup>39</sup> Consequently, corresponding does not equal ‘identical’, or perhaps not even ‘analogous’. Along these lines, and in the context of Article IX, one use of space by one State is a corresponding interest to another State’s use of space regardless of the fact that those uses may be different in nature - as what unites them is that they are both overlapping interests in a shared domain. Ensuring that ‘corresponding interests’ is widely construed will be key in interpreting this due regard obligation in the context of Dark and Quiet Skies, as well as in a variety of other space law contexts.

## **ANNEX B: MUSINGS ON THE SUBJECT OF INTERPRETATION – DAMAGES**

**By Carmen Artigas**

Please cite as C. Artigas. *Musings on the Subject of Interpretation – Damages*, in “The National and International Landscape Concerning Dark and Quiet Skies” (Boley, Rotola, and Yakushina). IAU CPS (2024).

### **Explanatory Note**

The WP2 team kindly asked me to develop further my past contribution on “damages” and interpretation, focusing on damages with respect to orbital light and spectrum pollution – delving a little bit into the opportunities given by the international liability regime, if appropriate.

As a matter of disclosure, I have never had any doubts that the outer space international instruments apply to astronomy (I respectfully acknowledge the opposite opinions on this issue) and that the Outer Space Treaty/Liability Convention pair contain enough elements to be applied to the reality of satellite constellations.

I consider that further work on the interpretation of these instruments and the deepening of consultations with State Parties may make it possible to claim damages under these instruments, a view that is also legitimately opposed by others.

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<sup>38</sup> S. Marchisio 2010, “Article IX”, in S. Hobe, B. Schmidt-Tedd., K.-U. Schrogl (eds.), “Cologne Commentary on Space Law. Volume I: Outer Space Treaty”, Carl Heymanns Verlag, Köln.

<sup>39</sup> “Corresponding”, *Merriam-Webster.com Dictionary*, Merriam-Webster, accessed 1 Dec. 2024, at: <https://www.merriam-webster.com/dictionary/corresponding>

In any case the following ideas try to cover both approaches. Amidst the many issues at stake in this matter and after the brilliant contributions concerning satellite constellations submitted to La Palma, I find it necessary to expand upon my initial contribution, entitled *“Attempting an initial argument for the implementation of the notion of damage in the Outer Space Treaty and the Liability Convention and the challenge of the Committee on the Peaceful Uses of Outer Space”*.

## **Previous Thoughts**

Would the various problems brought by satellite megaconstellations constitute a “damage” requiring preventive action as per international space law?

The Outer Space Treaty refers to the notion of “damage” in its Article VII defining it as: “the loss of life, personal injury or other impairment of health or loss of property or damage to property of States or persons natural or juridical or property of international intergovernmental organizations.”

As a preliminary step, let’s remind ourselves of some of the issues concerning damage and threats posed by satellite megaconstellations:

1. Some satellites in constellations are brighter than 99 percent of objects in the sky.
2. Too many satellites will harm the ability of optical telescopes to detect nearby asteroids threatening the Earth.
3. Mitigating measures by astronomers are insufficient and expensive in terms of money and research time.
4. Satellite transmissions interfere with radio telescopes.
5. The damage of satellites to radioastronomical observations is not new, as demonstrated by the impacts of global positioning systems.
6. Since the 70s and 80s radio astronomers have been unable to make satellite operations adhere to frequency regulations.
7. Light pollution causes a loss of natural heritage represented by the observation of the sky.
8. There is an ill-equipped governance system for LEO to handle very large systems of satellites.
9. The application of the “consumer electronic product model” to satellites could lead to multiple tragedies of the commons, such as the loss of access to certain orbits because of space debris, changes to the chemistry of Earth’s upper atmosphere and increased dangers on Earth’s surface from re-entered debris.
10. The overuse of certain orbital regions might result in a de facto exclusion of other actors.
11. Satellites can interfere with space telescope operations.
12. Satellite constellations can significantly affect the enjoyment of night skies, as well as prompt biodiversity concerns.
13. Recent research has confirmed interference with radio telescopes by unintended electromagnetic radiation from Starlink satellites.

Let me now reflect on how we could build a good case for enforcing international instruments to meet our concerns. To start, I note that the closer areas of space are part of the Earth environment, which naturally brings in considerations of environmental law and policy. I further note that the Dark and Quiet Skies II report discusses how the principles of sustainable development may apply to our challenge.

With this in mind, many sound studies have analyzed environmental principles within international law, born largely of the Declaration on Environment and Development, a result of the Conference on Environment and Development of 1992.

Such principles consider:

1. State sovereignty (clearly referring to the management of natural resources)
2. Duty not to cause environmental harm
3. Common but differentiated responsibilities
4. The polluter pays principle (still subject to legitimate controversies)
5. Environmental impact assessments
6. The precautionary principle
7. Public participation
8. Notification and consultation
9. Peaceful resolution of disputes

I would now like to delve a little bit into the ideas of precautionary measures and damage, both concepts being incorporated into space law instruments.

The precautionary principle is just that, a principle. Its reception in international binding instruments, even before its role in environment and development, is relevant to our work.

The precautionary principle enables decision-makers to adopt precautionary measures when scientific evidence about an environmental or human health hazard is uncertain and the stakes are high. It entails important components of risk assessment and risk management.

One of the interesting features of the precautionary principle is that it has the potential to reverse the burden of proof, potentially saving considerable money and resources.

Following the United Nations Conference on Environment and Development, a clear example of the principle's use is in the United Nations Framework Convention on Climate Change, including the following within Article 3:

“The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, considering that policies and measures to deal with climate change should be cost-effective to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should consider different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors. Efforts to address climate change may be carried out cooperatively by interested Parties.”

I think various ideas can be extracted from this provision, which I will analyze in the future. With this in mind, it is interesting to note that a Draft agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction uses the expression “precautionary principle or precautionary approach”,<sup>40</sup> reflecting the long-term reluctance of some countries to accept this notion as a principle and just recognize it as an approach.

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<sup>40</sup> Adopted at the end of the Intergovernmental conference on an international legally binding instrument under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (resumed fifth session New York, 20 February–3 March 2023).

## **Attempting a Response to the Issue of Damage and Threats from the Standpoint of the Outer Space Legal Instruments**

The first question that arises is whether some of these threats or damage could meet conditions expressed in Article IX of the Outer Space Treaty.

Since this document is intended to be a general one and mainly to the scientific community, I will try to focus on the issue of damage, responsibility and liability in a straightforward manner, basically aiming at encouraging possible actions to protect many activities from the impact of satellite megaconstellations.

Let's start by reminding ourselves of the second part of the definition of "damage" as a way of approaching the subject, i.e., "loss of property or damage to property of States or persons natural or juridical or property of international intergovernmental organizations."

Next, as a way of enriching the analysis, it is useful to consider what damage means under international responsibility. In this regard, it is helpful to approach the text adopted in 2021 by the International Law Commission entitled "Responsibility of States for Internationally Wrongful Acts", which, although a non-binding instrument, reflects an important consensus from international law experts from different countries, legal systems and cultures.

Article 1 of the document is crystal clear in the sense that every international wrongful act of a State entails the international responsibility of that State. An international wrongful act of a State according to the text refers to an action or omission attributable to the State under international law constituting a breach of an international obligation of the State.

It is important to bear in mind that the text, as in the Outer Space Treaty, expresses that the conduct of a person or group of persons shall be considered an act of a State under international law if the person or group of persons is acting under the control of that State. A breach of an international obligation, in this case the Outer Space Treaty, means that an act of that State is not in conformity with what is required by that obligation.

I will come back to the issue of reparation in the text when dealing with the subject of liability. For now, let's focus on the Outer Space Treaty's phrase "loss of property or damage to property of States or persons natural or juridical or property of international intergovernmental organizations."

In considering the various "damages" or "threats", I bear no doubt that satellite megaconstellations cause loss of property and damage to the normal operation of astronomical instruments, to the full enjoyment of the right to scientific investigation (another feature that deserves further development in future analysis); to the budgets allocated to the astronomical activities; to the important security role played by observatories in connection with near Earth objects; and so on.

I would expect that after the meetings in La Palma and Vancouver the astronomical community could cooperate with the legal teams to define and develop these damages/threats so as to bring these concerns clearly characterized to the relevant instance of COPUOS.

In selecting some provisions of the Outer Space Treaty to underscore its potential to back the claims about the possible damage/threats of satellites megaconstellations, I would quote the following:



Article I: the exploration of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries. Outer space... shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law.

Article VI: State parties to the Treaty shall bear international responsibility for national activities in outer space... whether such activities are carried on by governmental agencies or by non-governmental entities.

Article VII: Each State Party to the Treaty that launches or procures the launching of an object into outer space... and each State Party from whose territory or facility an object is launched is internationally liable for damage to another State party of the Treaty.

Article IX : .... "A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment."

With these in mind, along with the astronomical community providing inputs for characterizing damages, meetings like the one in La Palma may provide ample opportunity to explore State Parties availability to claim, for instance, the applicability of article IX. Indeed, requests under article IX would not be a suggestion or recommendation for consultation but a clear implementation of the Outer Space Treaty.

The above analysis is closely related to the issue of liability and I intend to finish this contribution with a preliminary approach on the subject matter.

The Convention on International Liability for damage caused by space objects of 1972 is a follow-up and development of article VII of the Outer Space Treaty and naturally it reproduces in its article I the definition of the term damage.

Article VIII expresses that "A State that suffers damage, or whose natural or juridical persons suffer damage, may present to a launching State a claim for compensation of such damage."

Article X raises an interesting question, since we are thinking of the continuous damage presented by the constellations and therefore the time limits may suffer modifications. The article rules that "a claim for compensation for damage may be presented to a launching State not later than one year following the date of the occurrence of the damage or the identification of the launching State which is liable."

It adds that "if however, a State does not know of the occurrence of the damage... it may present claim within one year following the date on which it learned of the aforementioned facts. However, this period shall in no event exceed one year following the date on which the State could reasonably be expected to have learned of the facts through the exercise of due diligence. The time limits shall apply even if the full extent of the damage may not be known. In this event, however the claimant State shall be entitled to revise the claim and submit additional documentation after the expiration of such time limits until one year after the full extent of the damage is known."

The above article is very relevant in connection with the cooperation of the international astronomical or other affected communities to produce sound evidence.

Article 12 provides a very interesting approach to the issue of compensation in the sense that:

“[T]he compensation which the launching State shall be liable to pay for damage under this Convention shall be determined in accordance with international law and the principles of justice and equity, in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf the claim is presented to the condition which would have existed if the damage has not occurred”

The above is logically a great challenge for all disciplines involved in the problems created by satellite megaconstellations and deserves future brainstorming on what is really “justice and equity”, as well as what would mean a full restoration.

The Convention allows for claims before national Courts, but it seems that, as in any matter of conflict or potential conflict, informal consultations are the best approach, with resorting to the Claims Commission being an advisable Plan B if consultation does not lead to a solution.

The text of the International Law Commission on Responsibility of States for International Wrongful Acts analyzed above describes a series of approaches to the notion of compensation under its Chapter II, Reparation for Injury, which deserve analysis in further contributions.

Undoubtedly what may seem a heavy and boring legal exercise is the essential substratum of an indispensable interdisciplinary approach to a real challenge. When the July 2023 issue of Nikkei Asia informed that Elon Musk dominates orbit with Starlink satellites taking 60 per cent of global launch business and that the current figure of [6000+] satellites may reach 42000 if permissions requested are granted, many questions arise. Are justice, equality and non-appropriation among others secured with this reality? There is also a delicate question concerning how NASA is making use of Space X services.

Similarly, the title of the New York Times article published 30 July 2023: “Elon Musk unmatched power in the stars” is another appealing challenge to consider.

### **Some Brief Comments on Article 31 of the Vienna Convention on the Law of Treaties**

Paragraph 1 of the Treaty, perhaps the most well-known, is the principle that “a treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.”

This principle is extremely important and must be applied exhaustively. There are a series of approaches to Treaty interpretation which offer important elements for correctly implementing this paragraph: (1) the textual approach, (2) the subjective approach, and (3) the teleological approach, which focuses on the Treaty’s object and purpose.

The three principles are not mutually exclusive, and each may clarify different features of interpretation. At the same time, within the principles, there are interesting approaches to interpretation, including effectiveness, the evolutionary interpretation, emerging consensus, and margin of appreciation.

The approach of emerging consensus is based on state practice and naturally sheds light on the how the treaty is being interpreted or the inputs provided by national legislation.

Finally, the “margin of appreciation” is a common judicial deference to respect the way in which States implement the treaty, whenever it does not go against the purpose of the treaty.

The teleological approach is an interesting field focusing on the purpose of the treaty and the way it could be interpreted to allow for transformations to suit new conditions.

The International Court of Justice often adheres to the expansive treaty interpretation, allowing paths that go beyond the literal approach to secure how the purpose of the treaty is accomplished.

Returning to Article 31, Paragraphs 2 and 3 convey valuable tools for carrying out the treaty interpretation. Paragraph 2 states:

2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes:
  - (a) any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty;
  - (b) any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty.

Such agreements or instruments include possible declarations made upon acceptance of the text of a treaty, as well as during signature or ratification.

Next, Paragraph 3 expands upon the instruments and agreements that can be used in the interpretation:

3. There shall be taken into account, together with the context
  - (a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;
  - (b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;
  - (c) any relevant rules of international law application in the relations between the parties.

Part (c) seems extremely relevant.

The last Paragraph of Article 31 states that “A special meaning shall be given to a term if it is established that the parties so intended”.

The above considerations just aim to provide a glimpse of the various foundations related to treaty interpretation, which necessarily require a thorough and responsible exercise of exegesis if contradictory opinions on the applicability of the Liability Convention arise, especially in connection with “damage” caused by satellite constellations under the Convention.

Connected with this, considering the interesting proposal of an advisory opinion on the matter by the International Court of Justice,<sup>41</sup> it is worth noting that Article 38 of its Statute allows the Court to apply: a) International conventions, whether general or particular, establishing rules expressly recognized by the contesting states; b) International custom, as evidence of a general practice accepted as law, d) the general principles of law recognized by [the community of nations]; d) subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of the rule of law.

Finally, it is further stated that the provision shall not prejudice the power of the Court to decide a case *ex aequo et bono*, if the parties agree thereto. Article 59 expresses that the decision of the Court has no binding force except between the parties and in respect of that particular case.

As a fundamental caveat, we must consider that we are referring to a phenomenon which is relatively new, and which probably will not give us too much substrate from the past as with other issues related to the Convention. I underscore the fact that we are facing new conditions, new threats, and new problems and thus our means of interpretation will necessarily be *sui generis*.

### **Proposed Outline for Future Brainstorming**

1. Ascertain the level of awareness/exchange/discussion concerning implementation of the OST and the Liability Convention to satellite constellations. Is it an issue at all? Refer to the China case.
2. Bring to the table the Outer Space Treaty and the Liability Convention, sharing views on how they could account for the damages described by the various stakeholders.
3. Identify possible gaps and the existence of additional instruments or means of interpretation.
4. Agree on a suitable instance for contributing the results of this brainstorming, which may be for instance within the group created by Chile and Spain at COPUOS.
5. Decide on a clear follow-up and establish a deadline for an initial discussion.

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<sup>41</sup> See Outer Space Institute, “Astro-ICJ” at <https://www.outerspaceinstitute.ca/astro-icj.html>, as well as Boley and Byers, “Astronomy and the Proliferation of Space Objects: Strategies for Addressing Orbital Light and Spectrum Pollution”, Outer Space Institute Reports (1), 2024, available at [outerspaceinstitute.ca](https://www.outerspaceinstitute.ca).