

ALL LINKS TO SLIDES AND VIDEOS WORK ON THE IAU385 PROGRAMME WEBPAGE AT
<https://research.iau.es/congreso/iau385/pages/programme.php>. Some on this page will be updated later with active links and a new version sent.

IAU SYMPOSIUM #385: Astronomy and Satellite Constellations: Pathways Forward

2 October - 6 October, 2023 on the Canary Island of La Palma, Spain

Sunday 1 October

Time (UTC+1)	Speaker	Title
15:00		Visit to Tajogaite
21:00		End of day

Monday 2 October

Time (UTC+1)	Speaker	Title
	Connie Walker (SOC Chair), Antonia Varela (LOC Chair)	Welcome and Opening Slides Video
9:00		Welcome to La Palma Video
9:15	Distinguished Officials	IAU Centre Overview Slides Video
10:00	Piero Benvenuti (IAU CPS Director)	Keynote: Streaks, Signals, and Space Junk: Facing the Challenges of Satellite Constellations Slides Video
10:20	Karen Howard (U.S. GAO's Acting Chief Scientist): KEYNOTE SPEAKER (invited)	BREAK with poster viewing
11:00	Jessica Heim (University of Southern Queensland): SESSION CHAIR for COMMUNITY ENGAGEMENT	Community Engagement Hub Introduction Video
11:30	Jessica Heim (University of Southern Queensland)	Perspectives on Satellite Constellations from Diverse Communities Indigenous cultural perspectives
	Elder Wilfred Buck (Opaskwayak Cree Nation), Alvin Harvey (Diné, Navajo Nation), Juan-Carlos Chavez (Kuahjipiri) (Sonoran Desert Tribes MX-US)	<i>If you would like to view this presentation, please contact CE hub co-lead Jessica Heim (community-engage_At_cps Dot iau Dot org)</i>
12:35	Lisa Ruth Rand	From Sputnik to Starlink: Historical Perspectives on Astronomy and Satellite Communications Video Extraterrestrial broadband touches down: Constructing nature and global internet connectivity with low-earth-orbit satellite internet infrastructure Slides Video
12:55	Donny Harry Persaud (Cornell University)	LUNCH Indigenous knowledges and kinship as a model for our future in Outer Space Video Countering the threat of the space pollution: awareness raising via sustainability narratives Video
14:30	Hilding Neilson (Memorial University of Newfoundland)	Communications & Outreach for the IAU CPS Slides Video
14:50	Nick Campion (University of Wales Trinity Saint David)	Space as shared environment and intangible cultural heritage Video
15:10	Mathieu Isidro (SKAO)	BREAK with poster viewing
15:30	Aparna Venkatesan (University of San Francisco)	Q&A / Speakers Panel Video
15:50		Poster lightning presentations & viewing Welcome cocktail reception, Casa Salazar, Santa Cruz de La Palma.
16:20		"Proteger el cielo es nuestro deber... pero ¿que tengo que ver yo con el Big-bang?"
17:30		Public Talk in the Teatro Circo de Marte (Spanish/Español) Slides Video
18:30		
19:30	Piero Benvenuti (IAU CPS Director)	
20:00		End of day (no organised evening meal)

Tuesday 3 October

Time (UTC+1)	Speaker	Title
	Mike Peel & Siegfried Eggli: SESSION CHAIRS for SatHub SESSION (Software & Observations)	Summary of SatHub, and the current observational status of satellite constellations Slides Video
9:00	Chris De Pree (NRAO), Anthony Beasley (NRAO), Sheldon Wasik (NRAO), Urvashi Rao (NRAO), Rob Selina (NRAO), Will Armentrout (GBO), Harvey Liszt (NRAO)	Strategies for Spectrum Coexistence Between Radio Telescopes and Satellite Networks Slides Video
9:15	Giorgio Siringo (ESO / ALMA)	ALMA spectrum management and synergies with other entities in Chile Video
9:30	Cees Bassa (ASTRON Netherlands Institute for Radio Astronomy)	Unintended electromagnetic radiation from satellite constellations Slides Video
10:00	Vincenza Tornatore (Politecnico di Milano)	Impact of large satellite constellations on VLBI radio astronomical observations for materialization of Celestial and Terrestrial Reference Frames and EOP estimation Slides Video
10:15	Federico Di Vruono (SKAO), Gary Hovey (Onsala Space Observatory)	Modelling satellite constellations for radio astronomy impact studies Slides Video
10:30	Daniel Polin (University of California, Davis/Rubin Observatory)	Systematic Effects From Low Earth Orbit Satellites in Rubin Observatory LSST Camera Slides Video
10:45	Abdelkarim Boskri (LPHEA Laboratory, Oukaimeden Observatory, Cadi Ayyad University/FSSM)	Advancements in satellite observation and the contributions from Oukaimeden Observatory Slides Video
11:00		BREAK with poster viewing
11:30	Harrison Krantz (University of Arizona)	The Steward Observatory LEO Satellite Photometric Survey Slides Video
11:45	Christian Adam (CITEVA, Centro de Astronomía U. de Antofagasta, Avda. U. de Antofagasta 02800, Antofagasta)	Estimating the impact to astronomy from the OneWeb satellite constellation using multicolour observations Video
12:00	Marta Bautista Durán (Yebes Observatory, IGN)	Satellite mega-constellation monitoring campaign using the VGOS radiotelescope at Yebes Observatory during a 24-hour VLBI session from the International VLBI Service for Geodesy and Astrometry (IVS) Slides Video
12:15	David Vincent Stark , Genoveva Micheva , Samuel T. Spencer , Zouhair Benkhaldoun , Benjamin Winkel	SatHub Panel: Statistics of Satellite Interference in Observatories Around the World Video
13:15		LUNCH
14:30	Olivier R. Hainaut , Sabine Moehler (ESO)	Satellite impact on spectroscopic observations: a phantom menace, or the constellations strike back? Slides Video
14:45	Weijia Sun (Leibniz-Institut für Astrophysik Potsdam, AIP)	Enabling Robust Spectroscopic Surveys with 4MOST in the Era of Satellite Megaconstellations through Real-time Always-on Satellite Tracking Slides Video
15:00	Danica Zilkova (Comenius University in Bratislava)	Spectroscopy of human-made space objects: from Low-Earth Orbit debris to satellite constellations and exotic outliers Slides Video
15:15	Spencer Bialek (University of Victoria)	StarUnLink: identifying and mitigating signals from communications satellites in stellar spectral surveys Slides Video
15:30	Nicolas Billot (University of Geneva)	Space surveillance as a by-product of space-based astronomical observations with CHEOPS Slides Video
15:45		BREAK with poster viewing
16:15	Julian Charles Christou (NOIRLab / Gemini)	The Impact and mitigation of Satellite Constellations on Astronomical Laser Guide Star Propagation Slides Video
16:30	Anthony Robert Watson (JBCA, University of Manchester)	Starlink in Your Backyard: A DIY Approach to Satellite Monitoring and Data Analysis Slides Video
16:45	Paul Andrew Daniels (FAS + RAS Megaconstellation WG, Optical)	FAS survey of the effect of satellite constellations on UK amateur astronomy Slides Video
17:00	Domingos da Silva Barbosa (Instituto de Telecomunicações)	PASO - space surveillance in a Dark Sky Destination Slides Video
17:30		Poster lightning presentations & viewing
18:30		Historical and cultural visit to Santa Cruz de La Palma. Meeting point: Teatro Circo de Marte. Full information.
20:00		End of day (no organised evening meal)

Wednesday 4 October

Time (UTC+1)	Speaker	Title
	Mike Peel & Siegfried Eggli: SESSION CHAIRS for SatHub SESSION (Software & Observations)	
9:00	David Galadí-Enríquez (Sociedad Española de Astronomía)	Analytical vs. Montecarlo simulations of satellite visibility Slides Video
	Jiří Šilha , Adam Rigan , Peter Jevčák , Matej Zigo , Tomáš Hrobár , Roman	Satellites and space debris photometric phase functions used for astronomical images contamination prediction

9:15 Đuriković (Comenius University in Bratislava)

[Slides](#) [Video](#)
[Satellite Optical Brightness](#)

9:30 Forrest Fankhauser (UC Davis)

[Slides](#) [Video](#)
[Nano-motheye ZnO surface functionalization to combat New Space light pollution of satellites constellations of small and nano-satellites without steerable solar panels](#)

9:45 Luc Damé (LATMOS CNRS Paris-Saclay University)

[Slides](#) [Video](#)
[Sharing experience from debris optical monitoring and attitude modelling](#)

10:00 Beatriz Jilete Calleja (GMV for ESA)

[Slides](#) [Video](#)
[Accurate optical tracking of orbital objects in severely trailed images. Application to low Earth orbit \(LEO\) satellites, extremely faint objects, and space debris](#)

10:15 Alex Drago Gonzalez, Jorge Núñez (Universitat de Barcelona)

[Slides](#) [Video](#)
[Space situational awareness at the site of the SKA-low using an SKA-low precursor radio telescope](#)

10:30 Dylan Grigg (Curtin University)

[Slides](#) [Video](#)
[Space Debris Mitigation and Spacecraft Operator Data Sharing Supporting Dark and Quiet Skies](#)

10:45 Jan Siminski (ESA)

[Slides](#) [Video](#)

11:00

[BREAK with poster viewing](#)

Andrew Williams and Richard Green: SESSION CHAIRS for the POLICY SESSION

11:30 Policy 1: Introduction from CPS and National Policy Updates

CPS Policy Hub Update

11:30 Andrew Williams

[Slides](#) [Video](#)
[US Regulatory Updates](#)

11:40 Yaswant Devarakonda (American Astronomical Society)

[Slides](#) [Video](#)
[EAS Policy Updates](#)

12:00 Sara Lucatello (INAF and EAS)

[Slides](#) [Video](#)
[Positioning astronomy towards satellite constellations](#)

12:10 Gyula Józsa (Max-Planck-Institut für Radioastronomie)

[Slides](#) [Video](#)

12:30

[Travel to Observatory. Departure time: 12:30. Meeting point: Avda. Marítima, n.48, Santa Cruz de La Palma.](#)

14:00

BREAK on arrival at ORM (collect lunch from the ORM visitor center)

14:15

Observatory Visit.

17:30

BREAK before leaving ORM

17:45

Travel back to Santa Cruz de La Palma. Water & Snack on Bus

19:15

End of day (no organised evening meal)

Thursday 5 October

Time (UTC+1)	Speaker	Title
	Andrew Williams and Richard Green: SESSION CHAIRS for the POLICY SESSIONS	
9:00	Policy 2: International Law and National Policy	
9:00	Rafael Moro Aguilar (Florida International University)	Report on the International Institute of Space Law and Light Pollution of the Night Sky Slides Video
9:15	Aaron Boley (University of British Columbia)	Progress on Work Package 2 of the IAU CPS Policy Hub: Identifying key questions and steps forward Slides Video
9:30	Giuliana Rotola (Sant'Anna School of Advanced Studies/ Outer Space Institute (UBC))	Protecting Dark and Quiet Skies: International Law Insights Slides Video
9:45	Yana Yakushina (University of Ghent)	National Approaches to the Protection of Dark and Quiet Sky Slides Video
10:00	Elena Cirkovic (Max Planck/Helsinki University/MIT Media Lab)	Satellite Constellations and duty to consult Slides
10:15	Tamara Blagojevic (IAU CPS and Space Court Foundation)	Particular examples of national dark and quiet skies legal frameworks in the Asia-Pacific, Middle-east and the European Regions Slides Video
10:30		International law and national policy - discussion
11:00		Video
11:30	Policy 3: Towards solutions for policymakers and regulators	BREAK with poster viewing
11:30	Ruskin Hartley (DarkSky International)	Defending Dark and Quiet Skies: Building a Global Coalition Slides Video
11:45	Pedro Sanhueza Perez (External advisor of the Chilean Ministry of Foreign Affairs)	Strategic Environmental Impact Assessment to regulate SATCONS Slides Video
12:00	Gyula Józsa (Max-Planck-Institut für Radioastronomie)	European radio astronomy protection and satellite constellations Slides Video
12:15	Adrien Saada (Space Sustainability Rating)	Towards the development of a Dark and Quiet Skies module for the Space Sustainability Rating Slides Video
		Proclamations as Grassroots Policy Products in Dark Skies Preservation

12:30 Amy Carissa Oliver (Dark Sky International Advocate)

[Slides](#) [Video](#)
[International Telecommunications Union](#)

12:45 Veronique Glaude (ITU)

[Slides](#) [Video](#)
[Merged Recommendations for Mitigating Impact](#)

13:00 Richard Green (University of Arizona)

[Slides](#) [Video](#)

13:15

LUNCH

14:20 Policy 4: Emerging challenges and future concepts

[Astronomy, Doughnuts, and Carrying Capacity](#)

14:20 Andrew Lawrence (University of Edinburgh)

[Slides](#) [Video](#)

[Emerging Threats in Space: a view of small states, Security and Sustainability](#)

14:30 Farjana Sharmin (South Asian University)

[Slides](#) [Video](#)

[Solution of a Devil's Advocate - Put Telescope in Space](#)

14:40 Lerothodi Leonard Leeuw (University of the Western Cape)

[Slides](#) [Video](#)

[Astronomy from the Moon](#)

14:50 Lorena Nicotera (University of Groningen)

[Slides](#) [Video](#)

[IRIS2 – A European satellite constellation](#)

Nadya Benbekhti-Winkel (Fraunhofer-Institut für Naturwissenschaftlich-Technische

15:00 Trendanalysen INT, Fraunhofer INT)

[Slides](#) [Video](#)

[UK Policy Updates](#)

15:20 Robert Massey (Royal Astronomical Society / University of Sussex)

[Slides](#) [Video](#)

15:30

BREAK with poster viewing

Tim Stevenson and Patricia Cooper: SESSION CHAIRS FOR THE INDUSTRY SESSION

[Industry & Technology Panel](#)

Tim Stevenson (I&T Co-Lead), David Goldstein (SpaceX), Patricia Cooper (Constellation

[Video](#)

16:00 Advisory, LLC)

[The Earth Space Sustainability Initiative \(ESSI\)](#)

17:15 Stewart Clark (ESSI)

[Video](#)

17:30

Poster lightning presentations & viewing

18:30

[Closing Dinner at the Real Club Nautico de Santa Cruz de La Palma](#)

21:30

[Star party at Museo Insular de La Palma - Greeting and presentation](#)

21:35 Max Alexander (Max Alexander Photography)

[Star party - Our Fragile Space: Protecting the Near-Space Environment – Photography exhibition and engagement project](#)

21:45

[Star party - musical quintet and timelapses of La Palma sky, blackout with lights from the city being turned off at 22:00. More information about the star party.](#)

23:00

End of day

Friday 6 October

Time
(UTC+1)

Time (UTC+1)	Speaker
9:00	Andrew Williams and Richard Green: SESSION CHAIRS for the POLICY SESSIONS
9:00	MAIN SESSION: Policy 4 (continued): Emerging challenges and future concepts
9:00	Roohi Dalal (Princeton University)
9:15	Aaron Boley (Outer Space Institute & University of British Columbia)
9:30	Kenneth MacLeod (Space Propulsion Synergy Team)
9:45	Robyn Woollands (University of Illinois)
10:00	David Koplow, Chris Johnson, Aaron Boley, Rajeswari Pillai Rajagopalan
11:00	Mike Peel, Siegfried Eggli: SESSION CHAIRS for SatHub HACKATHON (Software Session)
11:30	PARALLEL SESSION: SatHub Hackathon (until lunch - in MAC)
	Connie Walker: SESSION CHAIR for the PUBLIC SESSION of the UN DELEGATES & OBSERVERS MEETING
	MAIN SESSION: UN Delegates & Observers Meeting (public session - in theatre)
11:30	Video
13:15	
14:30	Federico DiVruno (IAU CPS Co-Director)
15:30	Connie Walker (SOC Chair, IAU CPS Co-Director)
15:50	

Title

[National Security Interests in Relation to Dark and Quiet Skies Advocacy](#)

[Slides](#) [Video](#)

[Astronomy, mega-constellations, and the International Court of Justice](#)

[Slides](#) [Video](#)

[Forecasting Numbers of Post-Mission Satellites, and Mitigation Methods](#)

[Slides](#) [Video](#)

[Light Pollution versus Climate Change: Are constellations always bad?](#)

[Slides](#) [Video](#)

[Policy 5: Panel Discussion](#)

[Video](#)

BREAK with poster viewing

LUNCH

Concluding session

[Slides](#)

Closing Ceremony

[Slides](#)

BREAK with poster viewing

- Mike Peel, Siegfried Eggli: SESSION CHAIRS for SatHub HACKATHON (Software Session)**
- 16:20** [PARALLEL SESSION: SatHub Hackathon \(until 18:00 - in MAC\)](#)
- Mila Francisco Ferrada & Piero Benvenuti: SESSION CHAIRS for the CLOSED SESSION of the UN DELEGATES & OBSERVERS MEETING**
- PARALLEL SESSION: UN Delegates & Observers Meeting (Closed session - Invitation only, until 18:00, in private room)
- 16:20** **Richard Green: SESSION CHAIR for the POLICY DISCUSSION SESSION (until 18:00 - in theatre)** [Video](#)
- 16:20** Travel to Fuencaliente to see the two volcanoes (Teneguía and San Antonio). [More information](#). Meeting point: [Restaurante Casa indianos, Avenida Los Indianos. Santa Cruz de La Palma](#).
- 18:00** See the two volcanoes (Teneguía and San Antonio), followed by wine tasting and snack while stargazing in the Interpretation Center of the Volcano of San Antonio. (Sunset is around 8pm.)
- 19:00** stargazing in the Interpretation Center of the Volcano of San Antonio. (Sunset is around 8pm.)
- 22:00** Travel to Santa Cruz de La Palma
- 23:00** **End of day** (no organised evening meal)

Summary of the Scientific Highlights of the IAU Symposium 385 on ‘Astronomy and Satellite Constellations: Pathways Forward’

Connie Walker for the IAU CPS Hub Leads and Management Team

The [IAU Symposium 385](#) on Astronomy and Satellite Constellations: Pathways Forward, held on 2–6 October 2023, was a big success. The Management Team and Hub Leads of the IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference ([IAU CPS](#)), in addition to members of the Scientific Organising Committee ([SOC](#)), were heavily involved in the preparation of sessions.

The Community Engagement sessions were fortunate to have presentations from traditional knowledge keepers. The speakers shared perspectives on their relationship with the sky and cosmos and discussed ways to co-create collaborative endeavours related to the night sky and space. We also heard from speakers with a background in history and science and technology studies, who helped us examine past and present space and astronomy issues.

The “SatHub” or software and observations sessions concentrated on challenges to ground-based and space based radio and optical astronomy (whether imaging or spectroscopy), as well as amateur astronomy. They also addressed strategies for co-existence in all of these categories. In recent years, various strategies for co-existence in terms of optical astronomy have been developed. There are now better models and data for satellite brightness, which are key to enabling mitigation, active avoidance, or use in compliance checks. Future observations by the CPS SatHub observing network will determine whether some coatings and [Bragg mirrors](#) on reflective surfaces of Starlink satellites will help and how well. For spectroscopy, better modelling and understanding of satellite spectra will enable the emission from satellites to be calibrated out of astronomical data. Autonomous imagers on large spectroscopic facilities can help identify when an exposure was contaminated. For space-based observatories, there are software solutions (Starunlink) for streak detection and elimination that may help. Ultimately SatHub is bringing all stakeholders together to tackle the constellation challenge.

The Policy sessions included awareness-raising and coordination. The Policy Hub is engaging a growing network of ~140 people in research and policy work and regular interactions with government affairs representatives from several national astronomical societies, observatories and spectrum managers. These sessions also included discussion on deliverables from the work packages the Policy Hub has undertaken (a position paper, Space Sustainability Rating, consolidating recommendations from the satcon related workshops (Dark & Quiet Skies [I](#) & [II](#) and SATCON [1](#) & [2](#)), lunar policy, etc.). Progress in policy-making in countries all around the world was also highlighted with the general message that steady interaction with policymakers and industry is required to raise awareness and promote the protection of dark and quiet skies. There is also a growing number of high-level [recognitions](#) of the topic of [dark](#) and [quiet skies](#).

The Industry and Technology session consisted of a panel including a representative from SpaceX, who provided an update on Starlink satellites and their mitigation measures. The Q&A highlighted a number of concerns regarding relationships with regulators, the state of the market and its limits, and the flow of information from operators to support independent researchers.

In light of the outcomes shared at the IAUS385, the next steps for everyone include examining the new information, requesting collaborations with some and inviting symposium participants who have not yet joined the IAU CPS to do so. You are welcome to look over the slides and video⁴ of individual presentations on the [IAUS385 website](#). You are also welcome to visit the [IAU CPS website](#)² and become a member.

Brief Executive Summary for the IAU Symposium 385 on ‘Astronomy and Satellite Constellations: Pathways Forward’

Connie Walker for the IAU CPS Hub Leads and Management Team

The IAU Symposium 385¹ on Astronomy and Satellite Constellations: Pathways Forward, held on 2–6 October 2023, was a big success. The Management Team and Hub Leads of the IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference² (IAU CPS), in addition to members of the Scientific Organising Committee (SOC)³, were heavily involved in the preparation of sessions⁴.

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NOTES & REFERENCES

- [1] IAU Symposium 385 on Astronomy and Satellite Constellations: Pathways Forward website: <https://research.iac.es/congreso/iaus385/>
- [2] IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference (IAU CPS) Website: <https://cps.iau.org/>
- [3] Scientific Organising Committee (SOC) of the IAU Symposium 385: <https://research.iac.es/congreso/iaus385/pages/symposium/organizers.php>
- [4] Program of the IAU Symposium 385: <https://research.iac.es/congreso/iaus385/pages/programme.php>
- [5] Bragg mirrors: https://www.rp-photonics.com/bragg_mirrors.html
- [6] Dark & Quiet Skies I: <https://noirlab.edu/public/news/noirlab2022/>
- [7] Dark & Quiet Skies II: <https://noirlab.edu/public/announcements/ann21039/>
- [8] SATCON1: <https://noirlab.edu/public/news/noirlab2022/>
- [9] SATCON2: <https://noirlab.edu/public/announcements/ann21039/>
- [10] European Council: <https://www.consilium.europa.eu/en/european-council/>
- [11] G7: <https://home.treasury.gov/policy-issues/international/g-7-and-g-20>
- [12] Earth Space Sustainability Initiative: <https://www.essi.org/>
- [13] UN COPUOS: <https://www.unoosa.org/oosa/en/ourwork/copuos/index.html>
- [14] The IAU CPS Hub Leads and Management Team: SatHub Co-Leads Siegfried Eggl (University of Illinois, USA), Mike Peel (Imperial College, UK), Meredith Rawls (University of Washington/Rubin Observatory, USA). Policy Hub Co-Leads Andy Williams (ESO, Germany), Aaron Boley (Outer Space Institute, Canada), Industry & Technology Hub Co-Leads, Chris Hofer (Amazon Kuiper, USA), Tim Stevenson (SKAO, UK), Patricia Cooper (Constellation Advisory, LLC, USA) (Advisor). Community Engagement Co-Leads: Jessica Heim (University of Southern Queensland, USA), John Barentine (Dark Sky Consulting, LLC, USA). IAU CPS Management Team Richard Green (Interim Director, USA), Federico DiVruno (Co-Director, SKAO, UK), Connie Walker (Co-Director, NOIRLab, USA). IAU Interim General Secretariat: Piero Benvenuti (Previous Director of IAU CPS, Italy/Paris).