UNISEC-Global The 14th Virtual Meeting

October 16, 2021, 22:00-24:00
(Standard Japan time GMT +9)

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Japan

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1. Opening Remarks

Prof. Sinichi Nakasuka, University of Tokyo

Prof. Nakasuka graduated with Ph.D. in Aeronautics and Astronautics at the University of Tokyo His main research is on astrodynamics and artificial intelligence. He had joined a computer manufacturer and became involved in research around Artificial Intelligence and automated manufacturing. He became a lecturer at the University of Tokyo in 1990. He was an assistant professor of the Research Center for Advanced Science and Technology, University of Tokyo, and a visiting research fellow in the United States. He has been a professor at the Department of Aeronautics and Astronautics since 2004. He has led the students in his lab, ISSL (Intelligent Space Systems Lab) in developing CubeSats and small satellite. He has been one of the pioneers of small satellite development.

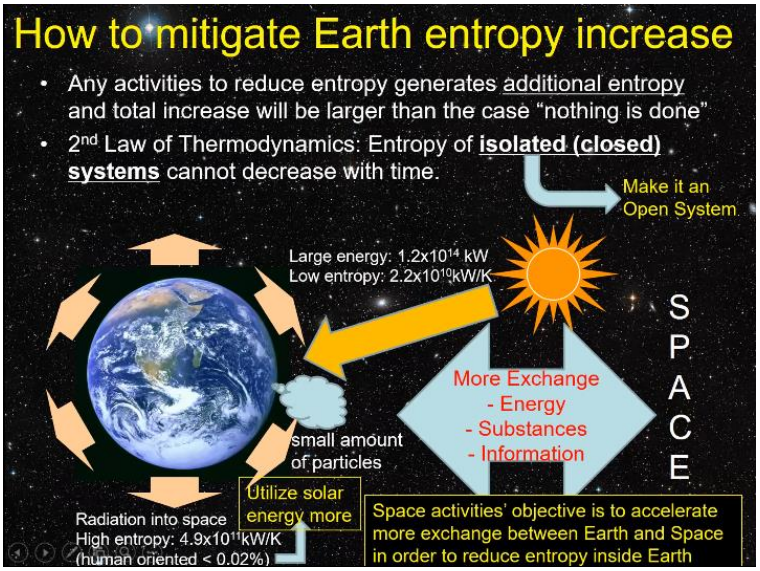
Pictured: Prof. Shinichi Nakasuka giving the opening remarks during meeting

Highlights:

- "Entropy" is related to number of possible states which indicates the level of randomness. Unpredictability and uselessness
- From structured, well organized to unstructured, uniform and messy
- Total entropy always increase
    - Local perspective in waste management, the entropy seems to decrease
    - However, for larger perspective large energy is required to generate waste. Increase entropy
    - For a nation, increase in entropy means increase in jobless rate, lack of food, political unrest, diseases
    - A nation can then enter war to decrease internal entropy but the total entropy always increases
    - In relationships, when someone is angry, the entropy is passed on to someone else, but again, the total entropy increases
    - A person growing up is structured, internally entropy decreases. But overall, the entropy increases because they throw away large entropy
- Many global issues like global warming, air pollution and so on are "Entropy Crisis"
- According to information theory, if you know something, entropy decreases
- A human grows by taking negative entropy (food, knowledge and entropy dump)
- Hypothesis: Humans are sensitive to entropy increase
    - Increasing entropy environment makes man nervous, uneasy and desire to escape

Highlights (Continued):

- Curiosity: Desire to reduce internal entropy
- Question now is how do we mitigate Earth entropy increase?
    - The challenge is to make our system an open system
    - One way is to use more solar energy
    - Another way is to exchange energy, substance and information in space
- Space activities' objective is to accelerate more exchange between Earth and Space in order to reduce entropy inside Earth



Pictured: Prof. Masatoshi Ohishi gives a presentation on The Beautiful Skies for All

2. Presentation on "The Beautiful Skies for All"

Prof. Masatoshi Ohishi, National Astronomical Observatory of Japan

Prof. Masatoshi Ohishi is the immediate past President of Commission F.3 (Astrobiology) of the International Astronomical Union and the head of the NAOJ's Spectrum Management Office. He is a radio astronomer with expertise in astrochemistry and astrobiology. So far, his team has discovered 17 interstellar molecules. He is leading a research attempt to find the simplest amino acid, glycine. He has also collaborated with major observatories across the world to build the Japanese Virtual Observatory. He's also an important figure in the effort to keep radio observatories free of radio interference.

Pictured: Prof. Masatoshi Ohishi gives a presentation on The Beautiful Skies for All

Highlights:

- Sad to see bright skies illuminated by city lights.
- If we go away from populated areas such as North America, major cities of Europe, India, the eastern part of China, Japan, and so on, we can see dark skies.
- At present, astronomers can see the Milky Way galaxy in a variety of wavelengths.
- Radio astronomy has been very useful in investigating the Universe
- By using an atomic hydrogen emission line, astronomers are able to understand that the Milky Way galaxy is a spiral galaxy.
    - The conclusion of Milky Way galaxy is a spiral galaxy was possible because radio waves are not absorbed by the interstellar dust particles.
- The ordinary matter consists of only 4.9 %, 26.8 % corresponds to dark matter and the remaining 68.3 % is composed of dark energy.
- It is surprising to know that we only know a small portion of the Universe.
- Astronomy has utilized satellite-borne telescopes, especially in gamma-ray, X-ray, ultraviolet, and infrared regions.
- These days, satellite technologies are advanced and now are able to launch mega-constellations. A famous one is Starlink:
    - According to Starlink, they are planning to launch 42,000 satellites in the near future, and currently, they have around 3,000 satellites in orbit.
- The Starlink satellites are nearly 550 km above sea level and they move very fast. So, the astronomical telescope cannot track such fast-moving objects. To measure the satellite brightness, astronomers decided to point a telescope to a fixed position where a satellite passes by.
- It is necessary to reduce satellite brightness.
- SpaceX tried to reduce the brightness of their satellites, so they launched an experimental satellite called Darksat.
- The Darksat worked well but was not sufficient for the astronomers.
- The astronomers needed much darker satellites.
- SpaceX introduced another satellite called VISORSAT which used sun visors to reduce the reflected light by the satellite.
- There is a need for new technologies to reduce satellite brightness.
- People need to establish international organizations for regulating satellite brightness.
- Radio astronomy also experiences radio interference.
- As radio objects emit at all frequency range, radio astronomers want to observe at all frequency range.
- Radio astronomers are eligible to claim protection in small portions of frequency range only.
- Recent technological advancements have enabled radio users to use higher frequency bands, such as the 3 mm band.
- Starlink satellites used to downlink in the frequency range between 10.7-12.7 GHz which was expected to cause serious radio frequency interference. So, after tough coordination, SpaceX agreed to suspend their channel to 10.7-10.95 GHz.
- As astronomers, it is our responsibility to select a site as radio-quiet as possible and to establish radio quiet zones.
- Finally, our sky is a shared natural resource by everybody. There are problems to be fixed. New ideas are required to solve the problems through technological advancements.

Q&A:

Is the visor used in VISORSAT is fairly effective? What about the cost performance? If the visors are too expensive, will SpaceX be doing it?

Prof. Masatoshi Ohishi: *Yes, the visor is effective. Currently, I have no answer on its cost. We need to ask SpaceX technicians or Elon Musk for this.*

Can we design telescopes to mitigate trail problems accordingly?

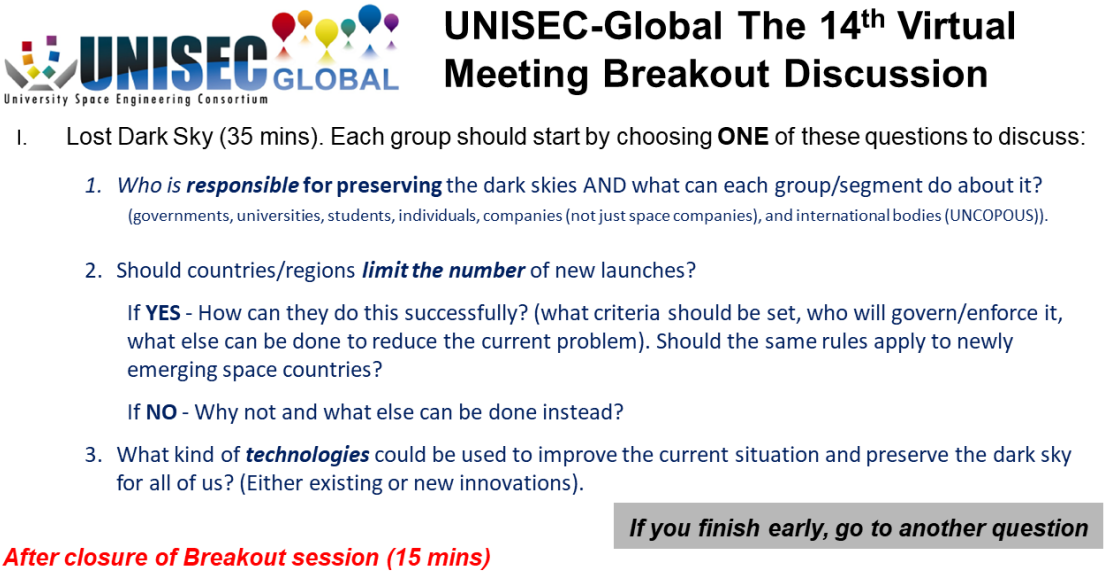
Prof. Masatoshi Ohishi: *That is one of the possibilities if there would be less number of satellites. But, as of today, there are more than 3,000 satellites. So, it would be very difficult to avoid all of them. Especially, when astronomers use wide-field cameras with a field of view of 2-3 degrees.*

Midori: *Isn't the paint manufactured and tested for space for the communication satellites – which makes it less reflective- too expensive to be used on all satellites.*
Prof. Masatoshi Ohishi: *Yes, it is true. That is why I said we need to develop new technologies at a reasonable cost. I think this is a new engineering issue. So, if we can develop such a wonderful coating at a reasonable cost, everybody will be happy as we can save a lot of money.*

Lawrence: *How feasible and effective will it be to conduct radio astronomy from orbit?*
Prof. Masatoshi Ohishi: *The radio astronomy community has launched several space-based radio telescopes in orbit. But we have to have very good surface accuracy of less than 100 μm to conduct high-frequency observations. At present, it is very difficult to achieve such a very good surface accuracy. Thus, it may take 10 or 20, or even 30 years from now which is not an optimal solution.*

3. Breakout Discussion and Sharing

Moderators: Nate Taylor, UNISEC-Global



Pictured: The topic subject for the breakout session regarding preserving the dark sky

Highlights:

- 35-minute discussion, divided into six groups
- Who is responsible, what is the limit for launches and what tech to use?

Group	Speaker	Highlights
Room 1	Charleston	Preserving Dark Sky - Painting satellite black (musou black absorbs 99.5% light) expensive - Thermal energy absorbed by satellite can be converted into energy for efficiency Radio astronomy - all the spectrum will be allocated for radio astronomers and satellite will adjust by dynamic spectrum access concept

Group	Speaker	Highlights
Room 2	Dr. Saja	Responsible for Preserving Dark Sky - Government, universities, company and everyone is responsible Limit number of new launches? - Multifunctional satellites - One Constellation for everybody - Government should not interact but an independent organization which works for benefits of everyone for new launches Technology Preserving Dark Sky - Filtering algorithms
Room 3	Kentaro Enokida	Responsible for Preserving Dark Sky - Sky has no boarder, international bodies, universities, company should Collab Limit number of new launches? - no limit on number of launches - equip observational components - develop satellite technology to solve the problem in long run
Room 4	Eyoas Areda	Responsible for Preserving Dark Sky - its international problem so international organs should work on it Limit number of new launches? - use single rocket to launch multiple satellites - Limiting launches and space activity is difficult as every country have national military missions - Cannot limit but manage the single rocket Technology Preserving Dark Sky - Ground based telescope to space-based telescopes for quality observation like Hubble
Room 5	Ana Rebeca	Responsible for Preserving Dark Sky - international organization to be fair, objective and unbiased Limit number of new launches? - Good economy and space tourism - Long terms benefits about insurance, safety, pollutions
Room 6	Yoshiyuki Yamada	Responsible for Preserving Dark Sky - International body should coordinate the program - Programs in developing country is not recognized Limit number of new launches? - Some restrictions are needed but specifying exact number is difficult - deorbit technology is important, short life span satellite deorbit quickly Technology Preserving Dark Sky - Cutting edge technology and less reflective technology

4. New Member Acknowledgment, Announcements and Closing

Rei Kawashima, UNISEC-Global

Pictured: Kawashima-san making announcements for the UNISEC-Global Community

Highlights:

- No new local chapters
- **7th Mission Idea Contest**
  - Final: Nov 13, 2021
  - Venue: X-Nihonbashi, Tokyo, done hybrid
  - Free online lecture http://www.spacemic.net/lecture.html
  - Details http://www.spacemic.net/
  - Finalists have been selected and will be announced on the website
    - Thailand x2, Taiwan, Turkey, USA, Costa Rica, Italy x2, Australia and Japan
- **7th Round Application for KiboCube is open, Deadline Dec 31, 2021**
  - UNOOSA and JAXA joint program, free launch opportunity (1U CubeSat)
- **JCUBE- Special discounted launch opportunity for 1U-3U x 6 CubeSats**
  - Maximum total of 12U per fiscal year (FY)
  - **Application duration: Nov 2021 to Dec 2021(TBC)**
  - Two categories in which one is for international collaboration
    - If no suitable Japanese partner, then there's a match making system
  - Category 2 is for Japanese domestic collaboration, max. of 2 satellites/FY
  - Both category is open for UNISEC-Japan
  - Further information will be available in UNISEC's webpage
  - J-CUBE office: info-jcube@unisec.jp

Highlights (Continued):

- **27th APRSAF (Asia Pacific Regional Space Agency Forum)**
  - Nov 30 – Dec 3, 2021, Virtual event
  - Free event, register at:http://www.aprsaf.org/
  - UNISEC will organize Higher Education Session
  - Part of the Space Education for All Working Group (SE4AWG) afternoon on Dec 1, 2021
  - **Abstract submission due date: Nov 1, 2021**
    - Engagement with universities for space education
    - Engagement with industry for higher space education
    - Gov/Agency projects, initiatives, and policy to foster higher space education
    - Best practices for delivering high-quality higher space education
    - More information: http://www.unisec-global.org/space_education.html

- **Next Virtual Meeting: November 20, 2021 10:00PM – 0:00 AM (JST)**
  - Theme: Deep Space Science and Exploration with Nano/micro satellites
  - Confirmed speakers:
    - Prof. Herman Steyn, Stellenbosch University
    - Prof. Ryu Funase, University of Tokyo/JAXA
    - MIC7 Winner (selected on Nov 13, 2021)
  - Local chapter presentation: TBD
  - UNISEC-Global Meetings takes place **Third Saturday** of almost every month in 2021

Pictured: Events for 2021 and 2022

- **2021 Planned Events**
  - IAC2021 in Dubai on October 25-29, 2021
  - MIC7 final presentation on Nov 13, 2021
  - iCASE 2021 in Hsinchu on Nov 11-16, 2021
  - IAA 1st African Symposium for Small Satellite (South Africa) on Nov 29 – Dec 1, 2021
  - APRSAF 2021 on Nov 30-Dec 3, 2021 in Vietnam
- **2022 Planned Events**
  - 10th Nano-satellite Symposium at 33rd International Symposium of Space Technology and Science (ISTS, Oita, Japan) on Feb 26-March 4, 2022
  - 8th UNISEC-Global Meeting and 8th Mission Idea Contest on (TBD) 2022


Pictured: Toshi Yoshida (left) and Kurosu (right) giving their thoughts on the meeting

Toshi Yoshida: *Thank you for inviting me. I really enjoyed the entropy and the issue presented by Nakasuka-san and dark skies. This is a wonderful opportunity. Kawashima-san and Maeda-san, thank you very much.*

Prof. Ohishi: *Happy to see very young and enthusiastic people, I was able to see bright future. Thank you very much*

Dr. Saja: *Thank for giving such wonder presentations*

Kurosu: *I will be at IAC, let's meet there*

George Maeda*: inform friends and colleague invite them in the UNISEC Global meeting for their benefits and expand the size of circle*

- Links shared on the comment section by Nate in regard to dark skies:

  https://www.iau.org/static/publications/dqskies-book-29-12-20.pdf

  https://www.globeatnight.org/6-steps.php

5. Participant Statistics

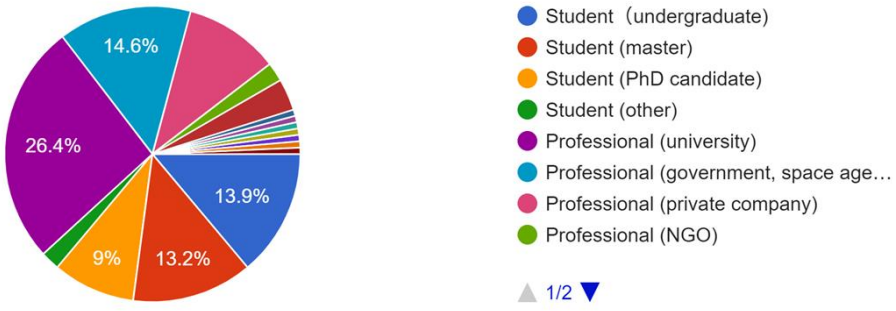
144 registered participants from **30** countries/regions participated in the 10th Virtual UNISEC-Global Meeting.

Country/Region	Number of registrants	Country/Region	Number of registrants
Australia	3	Oman	2
Belgium	1	Pakistan	1
Cameroon	1	Peru	1
Canada	1	Philippines	14
Chile	1	Russia	1
Egypt	3	Rwanda	4
Guatemala	1	Saudi Arabia	1
Iraq	1	Sudan	1
Italy	2	Taiwan	1
Japan	1	Thailand	1
Japan	84	Tunisia	3
Malaysia	1	Turkey	2
Mexico	1	United Kingdom	2
Myanmar	2	United States	1
Nepal	4	Zimbabwe	1

6. Participant Questionnaire

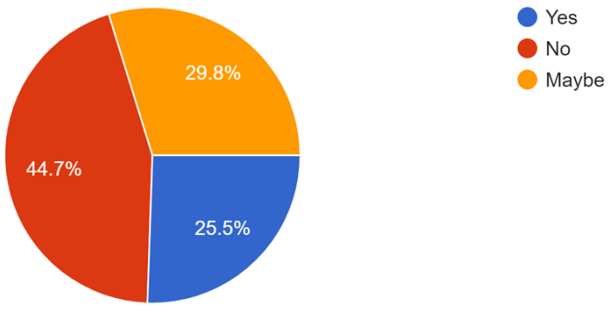
Student or professional?

144 responses



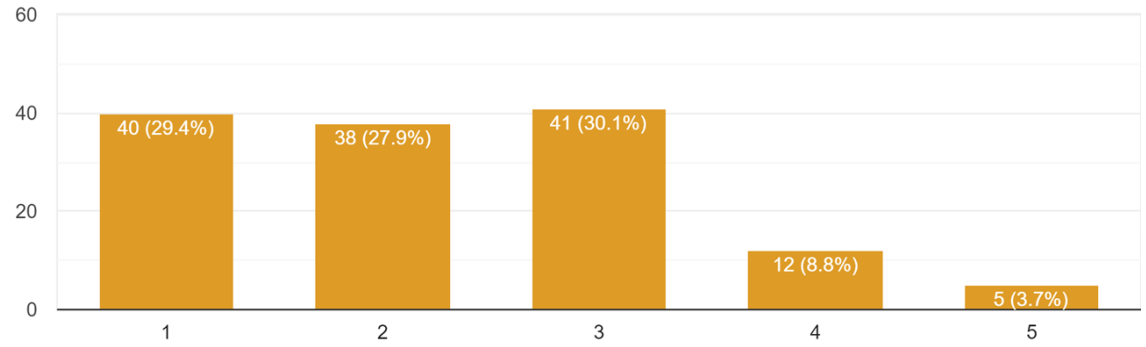
Are you familiar with the Lost Dark Sky problem?

141 responses



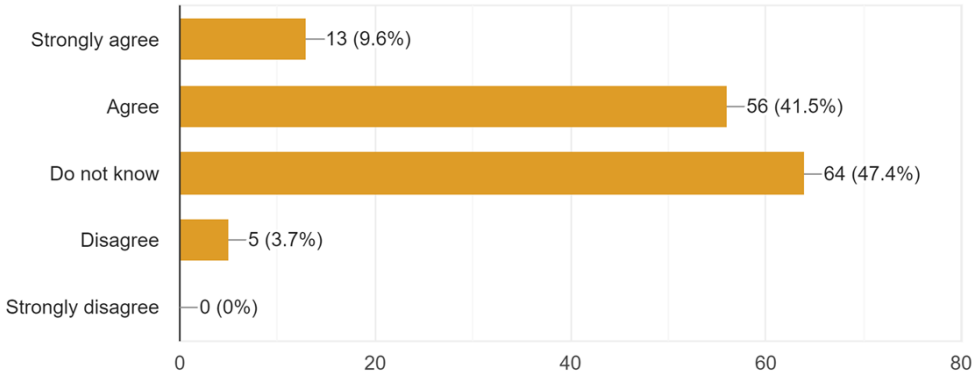
How serious do you think the "Lost Dark Sky" problem is?

136 responses



Do you think that there is a solution(s) for the "Lost Dark Sky" problem?

135 responses



Thank you