Group 4: Innovative Science Produced by Nano-Satellite Observation

Moderator: Masashi Kamogawa, Tokyo Gakugei University, Japan

Assistant: Mariana Bogdanova, Sofia University

6 Participants (8 persons in total)
[4: Science background,
4: Engineering background]
Participants (Group 4)

- Masashi Kamogawa (Moderator)
- Mariana Bogdanova (Assistant)
- Hiroki Uto
- Yasuyuki Miyazaki
- Zdravko Dimitrov
- Himmat Panag
- David Lam
- Jordan Bozmarov
Our motivation

• Can Cubesat observe practical scientific data?

• Were there scientific papers using Cubesat data?

• What is the plausible missions for Cubesat?
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<th>Not launched</th>
<th>Total</th>
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<td>Other picosats (0.1-1 kg)</td>
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<td>1.6%</td>
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It seems to easily employ ambitious missions.
Downlink of practically sampled data is available.
Recent scientific results

• Most relevant Cubesat for Science: Radio Aurora Explore (NASA-NFS / 3U)

• Ionospheric irregularities
• Energetic electron precipitation
• Space weather
What is better mission for Cubesat?

- Current Cubesat can use X-band communication.
- University and company are major developers.
- Many instruments are currently feasible for CubeSat.
- Good resolution is difficult to obtain. (in particular, camera and spectrometer)
What is feasible mission?

- Earthquake electromagnetic precursor
- Tsunami real-time monitoring
- Lunar mission (energetic particles around magnetotail, material resource)
- Animal behavior
- Microgravity, energetic charged particles, vacuum experiment for biology, material science etc.
- Radio noise temperature of passive measurement by two Cubesats (Microwave Radiometer)
Earthquake electromagnetic precursor

• Electromagnetic wave measurement
  \(\bigcirc\) Electric field, \(\times\) Magnetic field)
• In-situ plasma measurement (Langmuir probe)
• Long term observation (no interruption).
• Robust Cubesat is required.
Tsunami real-time monitoring

• Ship-GPS measurement - AIS communication
  → Ship number depends on season, weather etc.
• Ionospheric monitoring (TEC measurement)
  ⇒ Alternative method
Lunar mission
(energetic particles around magnetotail, material resource)

• Langmuir probes (magnetotail)
• Particle measurement (magnetotail)
• Spectrometer (material on the surface)
• Magnetic field (local magnetic field survey)

-> Concurrent two missions depends on space inside the satellite.
Animal behavior

1) Is anomalous behavior before the earthquake true?
2) Do animal feel magnetic field?

- Trackers embedded in the animal
- Store and forward system
- Several Cubesats are required.
Microgravity, energetic charged particles, vacuum experiment for biology, material science etc.

- Small biology probe (microscope etc.)
- Small material probe
Radio noise temperature of passive measurement by two Cubesats (Microwave Radiometer)

To create real-time map of noise temperature for the differential data.

• Antenna with very low noise temperature
• Synchronous detector
Conclusion

• Scientists push Cubesat developers to employ their scientific mission.

• Special sensors for Cubesat should be developed.

• Cubesat mission produces more data affordable for the science.