

Educational Activities Related to Satellite Laser Ranging at Hitotsubashi University

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Introduction – Education & Satellite/Lunar Laser Ranging

SLR/LLR: Nice mixture of simplicity and complexity

Measurement technique:

Simple concept, but complicated system.

Observation data:

Simple form (epoch & round-trip time), but not easily modelled.

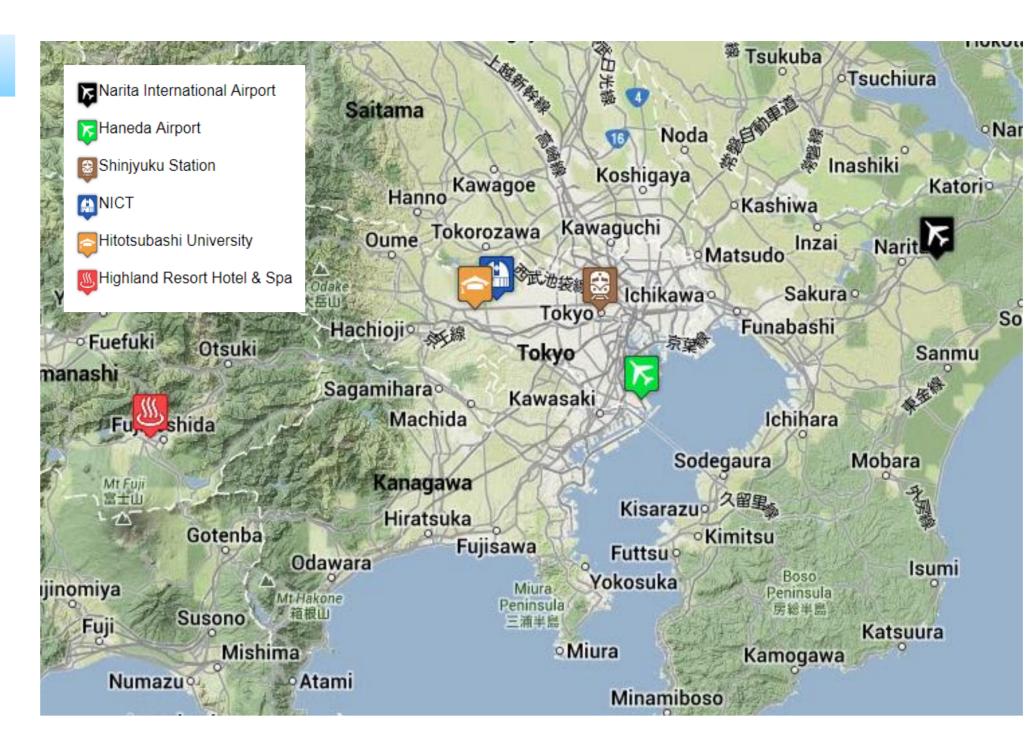
SLR/LLR: Mutual dependence of science and engineering

Satellite orbit & orientation, positioning, earth modelling etc.

⇔ Precise range measurement, new technologies

SLR/LLR: Transparent technology

- Using visible wavelengths. Driving a large telescope.
- (Usually) operated by humans.
- Simple key element: retroreflectors.



Hitotsubashi University

"C C": Originated from "Commercial college"

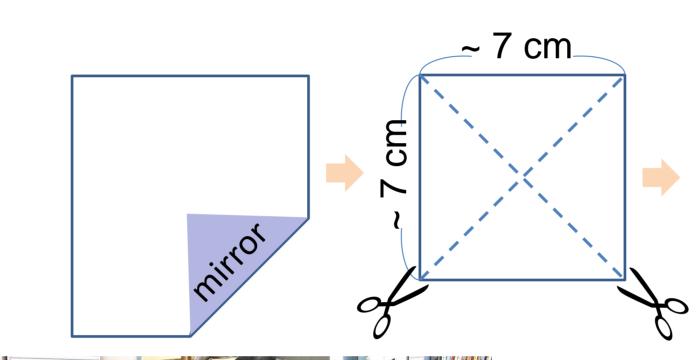
- Japan's premier institution for education and research in the
- social sciences. - 4 Faculties: Commerce and Management, Economics, Law,
- and Social Sciences. - 4,400 undergrad students and
- 2,00 grad students.
- Located in Kunitachi City, 4 km west of NICT Koganei.
- → Just one professor (Otsubo) and one assistant (Kobayashi) for geoscience + astronomy.

"Junior Seminar" (Small class ~ 8 students)

Example #1: Hand-made corner cubes

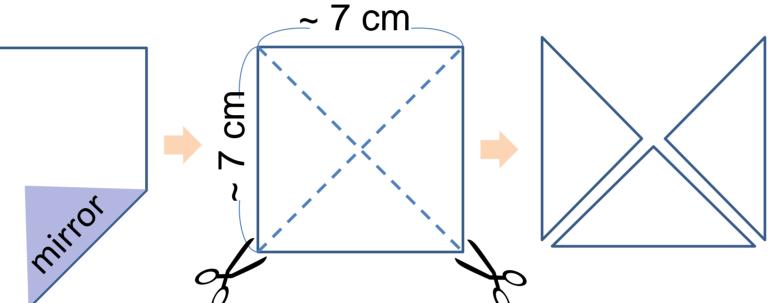


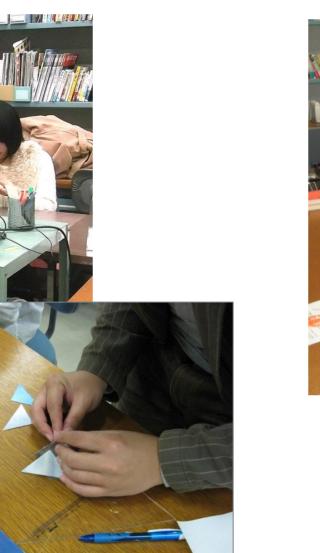
↑ Material: "Cutting Mirror"



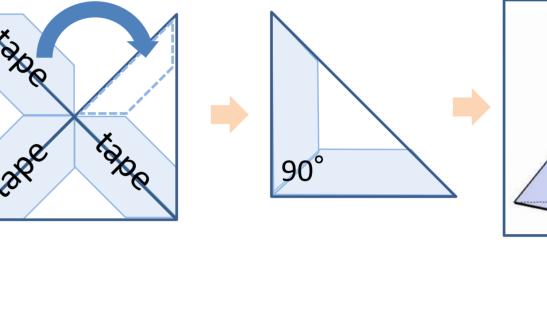


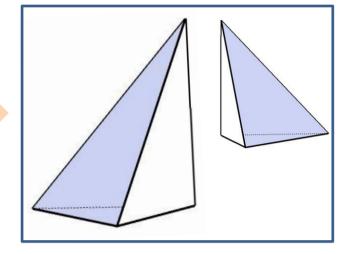
Manufacturing a ccr.





Quality Check #1: Illuminating a laser pointer.







↑ Exceptionally good case.

Quality Check #2: Simply taking a photo.

Example #2: Visiting and "visiting" SLR stations

Half-day tour to NICT Koganei. →

- 1.5-m telescope & SLR
- Time and frequency
- Exhibition room



Visiting Koganei every year





Other Examples:

- Search for Geostationary Satellites
- 3D Anaglyph
- Human Clocks vs Atomic Clocks
- GPS Treasure Hunting
- GEONET & Earthquake Events Google Earth Presentations
- Basic Optics and Camera
- Telescopes: Galileo and Newton
- Various Astrophotography Gravity and Antarctica (Guest)
- and more

- "Remote lectures" via Skype. → Virtual visit to SLR stations and discussions.
- Herstmoceux, UK (Appleby, 20 Dec 2007)
- Graz, Austria (Kucharski, 2 Nov 2010)





"Geoscience I/II" (Large class 50-100 students)

Geoscience I and II

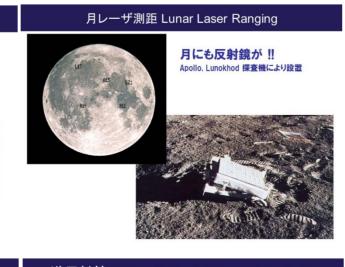
To widely cover geoscience and astronomy. To includes 1 or 2 lectures on space geodesy which include SLR/LLR. ↓

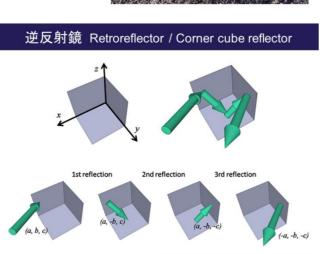


大口径·高速追尾



SLR のテクノロジ [2]





Demostration: Corner cubes around us



 \downarrow Looking through a USB microscope. \downarrow



Other Activities and Future Works

Senior (Department) Seminar

Goal: To help students to write their graduation thesis.

- 4 Examples of last year's students:
- LLR modelling (Nagasawa; see his poster), - Space edcation,
- National strategy with QZSS, and
- Aviation industry and space industry
- 3 Examples of this year's students
- SLR QC (Takakura; see his 2-min presentation on Tue AM),
- Space solar power system, and
- Augmented reality

To Do in the Future

Open/outward activities via our website, SNS or YouTube. Any ideas? New collaboration?