

Research Center for Advanced Information Science and Technology



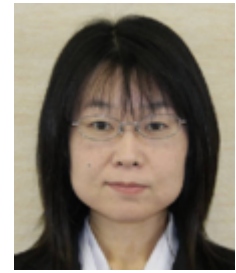
Haruo Terasaka
Professor



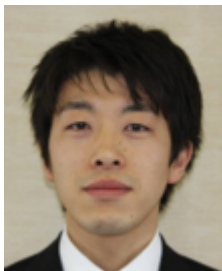
Pham Tuan Duc
Professor



Saji N. Hameed
Senior Associate Professor



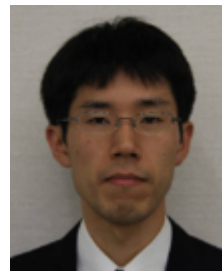
Yoshiko Ogawa
Associate Professor



Kohei Kitazato
Associate Professor



Chikatoshi Honda
Associate Professor



Takeaki Sampe
Associate Professor



Zhou Ping
Visiting Researcher



Yu Hui
Visiting Researcher

Centers

Refereed Journal Papers

- [chonda-01:2014] T. Matsunaga-Y. Ogawa R. Nakamura Y. Ryosuke Y. Yokota M. Ohtake J. Haruyama T. Morota C. Honda T. Hiroi S. Kodama Yamamoto, S. Calibration of NIR 2 of Spectral Profiler Onboard Kaguya/SELENE. *IEEE Transactions on Geoscience and Remote Sensing*, 52:6882–6898, 2014.

The Spectral Profiler (SP) is a visible-near infrared spectrometer onboard the Japanese Selenological and Engineering Explorer (SELENE), which was launched in 2007 and observed the Moon until June 2009. The SP consists of two gratings and three linear-array detectors: VIS (0.5-1.0 μ m), NIR 1 (0.9-1.7 μ m), and NIR 2 (1.7-2.6 μ m). In this paper, we propose a new method for radiometric calibration of NIR 2, specifically for the dark output (background) estimate, which is different from the previous method used for VIS and NIR 1. We show that the reflectance spectra of NIR 2 derived from the new radiometric calibration show less noise than those of the previous method. Based on an analysis of the reflectance spectra at exposure sites of the end-member minerals on the lunar surface, we demonstrated that the spectral features of the 2- μ m band in the NIR 2 spectra are consistent with those expected from the minerals inferred from the features of the 1- μ m band in the VIS and NIR 1 spectra. Finally, we examined the repeatability of the radiometric calibration of NIR 2 using the SP data near the Apollo 16 landing site observed at four different times. The typical difference in the reflectance at wavelengths $\lambda \sim 2.1 \mu$ m was a few percent, which is within the uncertainty due to the error in the background estimate, suggesting that there was no significant change in the sensitivity of NIR 2 over the mission period.

- [chonda-02:2014] K. Arimatsu-E. Egami Y. Hayano C. Honda J. Kimura K. Kuramoto S. Matsuura Y. Minowa K. Nakajima T. Nakamoto M. Shirahata J. Surace Y. Takahashi T. Wada Tsumura, K. Near-infrared Brightness of the Galilean Satellites Eclipsed in Jovian Shadow: A New Technique to Investigate Jovian Upper Atmosphere. *The Astrophysical Journal*, 789:article id. 122, 2014.

Based on observations from the Hubble Space Telescope and the Subaru Telescope, we have discovered that Europa, Ganymede, and Callisto are bright around 1.5 μ m even when not directly lit by sunlight. The observations were conducted with non-sidereal tracking on Jupiter outside of the field of view to reduce the stray light subtraction uncertainty due to the close proximity of

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Jupiter. Their eclipsed luminosity was 10^{-6} - 10^{-7} of their uneclipsed brightness, which is low enough that this phenomenon has been undiscovered until now. In addition, Europa in eclipse was $1/10$ of the others at $1.5 \mu\text{m}$, a potential clue to the origin of the source of luminosity. Likewise, Ganymede observations were attempted at $3.6 \mu\text{m}$ by the Spitzer Space Telescope, but it was not detected, suggesting a significant wavelength dependence. It is still unknown why they are luminous even when in the Jovian shadow, but forward-scattered sunlight by hazes in the Jovian upper atmosphere is proposed as the most plausible candidate. If this is the case, observations of these Galilean satellites while eclipsed by the Jovian shadow provide us with a new technique to investigate the Jovian atmospheric composition. Investigating the transmission spectrum of Jupiter by this method is important for investigating the atmosphere of extrasolar giant planets by transit spectroscopy.

[kitazato-01:2014] S. Tachibana, M. Abe, M. Arakawa, M. Fujimoto, Y. Iijima, M. Ishiguro, K. Kitazato, N. Kobayashi, N. Namiki, T. Okada, R. Okazaki, H. Sawada, S. Sugita, Y. Takano, S. Tanaka, S. Watanabe, M. Yoshikawa, and H. Kuninaka. Hayabusa2: Scientific importance of samples returned from C-type near-Earth asteroid (162173) 1999 JU3. *Geochemical Journal*, 48:571581, 2014.

[saji-01:2014] P. Guo-Saji N H Huo, L. and D. Jin. The role of tropical Atlantic SST anomalies in modulating western North Pacific tropical cyclone genesis. *Geophysical Research Letters*, 42:doi:10.1002/2015GL063184, 2015.

published

[tdpham-01:2014] T.D. Pham. Classification of complex biological aging images using fuzzy Kolmogorov-Sinai entropy. *Journal of Physics D: Applied Physics*, 47:485402, 2014.

SCI journal

[tdpham-02:2014] X. Sirault R. Furbank T.D. Pham X. Tan, C. Sun. Feature matching in stereo images encouraging uniform spatial distribution. *Pattern Recognition*, 48:2530–2542, 2015.

SCI journal

[tdpham-03:2014] C. Zhang T.D. Pham R. Su, C. Sun. A novel method for dendritic spines detection based on directional morphological filter and

shortest path. *Computerized Medical Imaging and Graphics*, 38:793–802, 2014.

SCI journal

[tdpham-04:2014] T.D. Pham. The butterfly effect in ER dynamics and ER-mitochondrial contacts. *Chaos, Solitons & Fractals*, 65:5–19, 2014.

SCI Journal

[tdpham-05:2014] T. Fujita T. Sakamoto T. Tsunoyama, T.D. Pham. Identification of intestinal wall abnormalities and ischemia by modeling spatial uncertainty in computed tomography imaging findings. *Computer Methods and Programs in Biomedicine*, 117:30–39, 2014.

SCI journal

[tdpham-06:2014] R. Su T.D. Pham C. Zhang, C. Sun. Clustered nuclei splitting via curvature information and gray-scale distance transform. *Journal of Microscopy*, pages DOI: 10.1111/jmi.12246 (e-published ahead of print), 2014.

SCI journal

[tdpham-07:2014] X. Sirault R. Furbank T.D. Pham X. Tan, C. Sun. Stereo matching using cost volume watershed and region merging. *Signal Processing: Image Communication*, 29:1232–1244, 2014.

SCI journal

[tdpham-08:2014] C. Zhang T.D. Pham R. Su, C. Sun. A new method for linear feature and junction enhancement in 2D images based on morphological operation, oriented anisotropic Gaussian function and Hessian information. *Pattern Recognition*, pages 3193–3208, 2014.

SCI journal

[tdpham-09:2014] T.D. Pham. Spatial uncertainty modeling of fuzzy information in images for pattern classification. *PLoS ONE*, 9:8:e105075. DOI:10.1371/journal.pone.0105075., 2014.

Open access, SCI journal

[tdpham-10:2014] C.T. Truong K. Okamoto T. Futaba S. Kanemoto M. Sugiyama L. Lampe T.D. Pham, M. Oyama-Higa. Computerized assessment of communication for cognitive stimulation for people with cognitive

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decline using spectral-distortion measures and phylogenetic inference. *PLoS ONE*, 10:3:e0118739. doi:10.1371/journal.pone.0118739, March 2015.

SCI journal

[yoshiko-01:2014] Yoshiko; Hirata Naru; Terazono Junya; Demura Hirohide; Matsunaga Tsuneo; Yamamoto Satoru; Yokota Yasuhiro; Ohtake Makiko; Otake Hisashi Hayashi, Yohei; Ogawa. Web GIS system Gekko for data analysis of Kaguya's Spectral Profiler. *Journal of Space Science Informatics Japan*, 4:91–103, March 2015.

We developed a web GIS system "Gekko". This paper mainly describes a web GIS system for viewing the hyperspectral data observed by Spectral Profiler (SP) onboard Kaguya, a Japanese lunar orbiter. Gekko means moon light in Japanese. Users can browse easily the observation points of SP on the lunar image, focusing on the interesting areas. Once an observation point is selected, then the spectral data are displayed in many graphs. The users can download the plotted SP data in the graphs, too. This system was developed by Hayashi and University of Aizu team. The SP data used in the system are provided by Japan Aerospace Exploration Agency and National Institute for Environmental Studies. Gekko will be extended beyond a viewing tool and develop into a new analysis tool which contributes to the science community.

[yoshiko-02:2014] Ryosuke Nakamura, Satoru Yamamoto, Tsuneo Matsunaga, Yoshiko Ogawa, Yasuhiro Yokota, Yoshiaki Ishihara, and Takahiro Hiroi. The New Perspective of Evolution of Lunar Mantle and Crust Based on Spectroscopic Observation Result by Lunar Exploration Satellite "Kaguya". *Yuseijin (Planetary People): The Journal of Japanese Society of Planetary Science*, 23:15–24, 2014.

We conducted bulk analysis of data obtained by Spectral Profiler (SP) on Lunar Exploratio Satellite "Kaguya", and examined global distribution of rock facies of rocks rich in olivine and low-Ca pyroxene. We conclude based on this research that (1) olivine is located mainly around relatively small impact basin such as Mare Moscoviense and Mare Crisium that have thin crust (2) low-Ca pyroxene is mainly located around three major impact basin on the Moon, South Pole-Aitken, Mare Imbrium and Procellarum basin.

Refereed Proceeding Papers

- [kitazato-02:2014] A. Fujiwara and K. Kitazato. Photometric Measurements of Analog Materials for Asteroid Organics. In *46th Lunar and Planetary Science Conference*, number 1832, page 2204, March 2015.
- [kitazato-03:2014] K. Kitazato, T. Iwata, M. Abe, M. Ohtake, S. Matsuura, T. Arai, Y. Nakauchi, K. Tsumura, N. Hirata, H. Senshu, and S. Watanabe. In-Flight Performance of the Hayabusa-2 Near-Infrared Spectrometer (NIRS3). In *46th Lunar and Planetary Science Conference*, number 1832, page 1856, March 2015.
- [kitazato-04:2014] Y. Nakauchi, M. Abe, A. Tsuchiyama, K. Kitazato, T. Matsumoto, and R. Ishigami. Weathering Effects of Solar Wind Protons on Spectral Shape of Silicate Minerals. In *46th Lunar and Planetary Science Conference*, number 1832, page 1828, March 2015.
- [saji-02:2014] Saji N H Harvey, P. and W. Vanderbauwhede. Accelerating Lagrangian Particle Dispersion in the Atmosphere with OpenCL Across Multiple Platforms. In *Proceedings of the International Workshop on OpenCL*, page doi:10.1145/2664666.2664672, 2014.
published
- [tdpham-11:2014] T.D. Pham X. Tan, C. Sun. Soft cost aggregation with multi-resolution fusion. In *European Conference on Computer Vision*, volume 8693, pages 17–32. Springer, 2014.
Springer LNCS
- [tdpham-12:2014] T.D. Pham. Nonstationary mapping of spatial uncertainty for medical image classification. In *Int. Conf. Medical Biometrics*, pages 164–168. SPIE, 2014.
SPIE-sponsored conference
- [tdpham-13:2014] T.D. Pham. Modeling spatial uncertainty of imprecise information in images. In *The Asia-Pacific Signal and Information Processing Association*, pages ISBN 978–616–361–823–8. IEEE, 2014.
IEEE-sponsored conference
- [tdpham-14:2014] T.D. Pham. Image classification with indicator kriging error comparison. In *Int. Conf. Image and Signal Processing*, volume 8509, page 433440. Springer, 2014.
Springer LNCS

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[tdpham-15:2014] T.C. Thang T. Fujita T. Sakamoto T.D. Pham, T. Tsunoyama. Image classification of bowel abnormalities and ischemia. In *IEEE Int. Conf. Image Processing*, pages 2764–2768. IEEE, 2014.

IEEE conference

[tdpham-16:2014] K. Ichikawa T.D. Pham. Characterization of cancer intracellular space using the K-S entropy for images. In *IEEE TENCON*, page paper index 00178. IEEE, 2014.

IEEE conference

[tdpham-17:2014] M. Oyama-Higa T.D. Pham. Photoplethysmography technology and its feature visualization for cognitive stimulation. In *2015 IEEE Int. Conf. Industrial Technology*, pages 1735–1740. IEEE, March 2015.

IEEE conference

[tdpham-18:2014] T.D. Pham. Dynamic-time-warping analysis of feature-vector reliability. In *LNEE*, volume 339, pages 235–241. Springer, February 2015.

Springer LNEE

[tdpham-19:2014] T.D. Pham X. Tan, C. Sun. Multipoint filtering with local polynomial approximation and range guidance. In *IEEE Conference on Computer Vision and Pattern Recognition*, pages 2941–2948. IEEE, 2014.

IEEE conference

[tdpham-20:2014] T.D. Pham. Detecting mitochondria in intracellular images with nonstationary indicator kriging. In *IEEE TENCON*, page paper index 00018. IEEE, 2014.

IEEE conference

[yoshiko-03:2014] Nakamura R. Matsunaga T. Ogawa Y. Ishihara Y. Morota T. Hirata N. Ohtake M. Hiroi T. Yokota Y. Haruyama J. Yamamoto, S. Global Distribution of Areas with Featureless Spectra on the Moon: Eroded Lunar Primordial Crust? In *46th Lunar and Planetary Science Conference*, page 1285, March 2015.

Global distributions of exposure sites of various lunar major minerals have been revealed from the global survey using the spectral data obtained by Spectral

Profiler (SP) onboard SELENE/Kaguya [e.g., 1-4]. These studies are conducted based on the diagnostic absorption bands of 1 μ m and 2 μ m. On the other hand, it has been reported that several sites on the Moon exhibit no absorption bands for 1 μ m and 2 μ m (hereafter featureless (FL) spectra) [e.g., 5,6]. For the interpretations for the origin of FL spectra, we need to understand the global occurrence trends of FL points on the Moon. Thus, we conducted the global survey using SP data to reveal the global distribution of FL points.

[yoshiko-04:2014] Nakamura R. Kodama S. Yamamoto N. Demura H. Hirata N. Ogawa Y. Terazono, J. Recent Advancement of System Development of WISE-CAPS: A WebGIS-Based Lunar and Planetary Data Collaboration System. In *46th Lunar and Planetary Science Conference*, page 1725, March 2015.

We made constant enhancement of WISE-CAPS system since start of its development in 2008. Currently, we are focusing our development on usability and web appearance.

[yoshiko-05:2014] Yamamoto S. Matsunaga T. Ogawa Y. Ohtake, M. Global Compositional Investigation of Mafic Silicate Phase of the Lunar Highland Crust Based on Remote Sensing Reflectance Spectra. In *46th Lunar and Planetary Science Conference*, page 1822, March 2015.

This study investigated the mafic silicate phase and estimated its composition within the PAN layer globally by using remote sensing reflectance spectra of the lunar surface.

[yoshiko-06:2014] T.; Tanaka S.; Taguchi M.; Imamura T.; Arai T.; Senshu H.; Ogawa Y.; Demura H.; Kitazato K.; Nakamura R.; Kouyama T.; Sekiguchi T.; Hasegawa S.; Matsunaga T.; Wada T.; Takita J.; Sakatani N.; Horikawa Y.; Kuwano S.; Helbert J.; Mueller T. G.; Hagermann A.; Hayabusa2 TIR Team Okada, T.; Fukuhara. Thermal Infrared Imager TIR on Hayabusa2 for Observation of Asteroid (162173)1999JU3. In *45th Lunar and Planetary Science Conference*, page 1201, March 2014.

We have developed and calibrated Thermal Infrared Imager TIR for investigating thermo-physical properties of C-class near-Earth sub-km sized asteroid (162173) 1999JU3 in Hayabusa2 mission. TIR shows its performance as good as expected during the in-flight test after launch. We summarize development, pre-flight calibration, and in-flight performance of TIR, as well as its future observation plan.

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Unrefereed Papers

[chonda-03:2014] T.; Hirata N.; Morota T. Honda, C.; Kinoshita. Detection abilities of secondary craters based on the clustering analysis and Voronoi diagram. In *European Planetary Science Congress 2014*, pages EPSC2014–119, April 2014.

[chonda-04:2014] C. Honda N. Hirata Ito, R. and T. Morota. Assessment of Spatial Distribution of Basin Scale Crater on the Lunar Surface. In *European Planetary Science Congress 2014*, pages EPSC2014–121, April 2014.

[terasaka-01:2014] T. Ueno and H. Terasaka. The prediction of solar radiation using a cloud resolving model CReSS for PV power generation. In *Proceeding of 28th Symposium of Computational Fluid Dynamics*. The Japan Society of Fluid Mechanics, December 2014.

[terasaka-02:2014] Y.Kikuchi and H. Terasaka. Numerical Simulation of Mixture Process in Impinging Droplet. In *17th Symposium of Applied Mechanics*. Japan Society of Civil Engineers, 2014.

[yoshiko-07:2014] Yoshiko Ogawa, Hirohide Demura, Naru Hirata, Chikatoshi Honda, Kohei Kitazato, Tetsuo Yamamoto, Tomokatsu Morota, Naoki Kobayashi, Participants of the 7th lunar, and planetary data analysis practice meeting. Report of the 7th lunar and planetary data analysis practice meeting. In *Yuseijin (Planetary People): The Journal of Japanese Society of Planetary Science*, volume 23, pages 164–167, June 2014.

The Lunar and Planetary Data Analysis Practice Meeting is a hands-on and short-concentrated meeting held from 2009 once or twice annually aiming for cultivation of human resources dedicated to future lunar and planetary exploration and expansion of study of lunar and planetary science. In this 7th meeting, we set the theme “lunar surface information probing from visible - near-infrared spectral data”. The goal is to realize mineral composition and its weathering of rocks in lunar surface by self-analysis attempt using precise spectral data obtained by Japanese Lunar exploration satellite “Kaguya”. Satoru Yamamoto, National Institute of Environmental Studies, and Yoshiko Ogawa, CAIST/ARC-Space, The University of Aizu, initiated analysis of Kaguya’s spectral data.

Grants

- [yoshiko-08:2014] Ysuihiro Hisada, Hirohide Demura, Naru Hirata, and Yoshiko Ogawa. Bog environment monitoring utilizing satellite radar data (Principal Investigator: Yasuhiro Hisada), FY2013 Fukushima Prefectural Foundation for the Advancement of Science and Education., 2014.
- [yoshiko-09:2014] Y. Ogawa. Grant-in-Aid for Scientific Research, Scientific Research (C): Construction of Lunar Surface Mineral Composition Map Based on Lunar Exploration Data and Study of Lunar Surface Analysis by Web-GIS (Mathematical and Physical Science / Earth and Planetary Science / Solid Earth Planetary Physics), 2014.
- [yoshiko-10:2014] Yasuhiro Hisada, Hirohide Demura, Naru Hirata, and Yoshiko Ogawa. Bog environment monitoring utilizing satellite radar data (Principal Investigator: Yasuhiro Hisada), FY2013 Fukushima Prefectural Foundation for the Advancement of Science and Education., 2014.

Academic Activities

- [chonda-05:2014] C. Honda M. Nishino H. Nagaoka Morota, T., April 2014.
Theme Chair, Lunar sciences and exploration
- [sampe-01:2014] T. Sampe, 2014.
member of Web Management and Information Technology Committee of the Meteorological Society of Japan
- [sampe-02:2014] T. Sampe, 2014.
Reviewer for Journal of Climate
- [terasaka-03:2014] H. Terasaka, 2014.
councilor
- [yoshiko-11:2014] Y. Ogawa, April 2014.
vice chairman of the committee of JpGU gender equality

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[yoshiko-12:2014] Y. Ogawa, April 2014.
regular member

[yoshiko-13:2014] Y. Ogawa, April 2014.
regular member

Ph.D and Others Theses

[kitazato-05:2014] Ayaka Fujiwara. Master Thesis: Photometric Measurements of Analog Materials of C-type Asteroid Organics ”,, University of Aizu, 2015.

Thesis Advisor: K. Kitazato

[yoshiko-14:2014] Norihisa Toyosaki. Graduation Thesis: Condition for Water Infiltration in Snowy Highland Marshes Based on ALOS/PALSAR Data Analysis, University of Aizu, March 2015.

Thesis Advisor: Y. Ogawa

[yoshiko-15:2014] Maria Morihira. Graduation Thesis: Evaluation of admittance computations for estimating the lithospheric thickness on Mars, University of Aizu, March 2015.

Thesis Advisor: Y. Ogawa

Others

[yoshiko-16:2014] Yoshiko Ogawa, 2014.

Working Group Member, MELOS (Mars Explorer) Project

[yoshiko-17:2014] 2014.

Working Group member, MELOS (Mars Explorer) Project

[yoshiko-18:2014] 2014.

Working Group member, JUICE/GALA (Icy Satellite exploration) Project

[yoshiko-19:2014] JAXA/ISAS Science Group member

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[yoshiko-20:2014] 2014.

Working Group member, JUICE/GALA (Icy Satellite Exploration) Project.

[yoshiko-21:2014] 2014.

Collaborative researcher, Hayabusa 2 Project (TIR/Operation Planning)

[yoshiko-22:2014] 2014.

Part-time assistant professor, Shibaura Institute of Technology (Division of Applied Chemistry, “Applied Physics”)

[yoshiko-23:2014] 2014.

Co-Investigator, Kaguya Project (LISM)