

Ryuji Hirayama

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Research Interests

Volumetric display, Holography, Steganography, Directional display, Optics, Functional materials, Human-Computer Interaction, Computational fabrication, Acceleration of computing

Education

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| Apr. 2014 – Mar. 2017 | Doctor of Philosophy in Engineering
Graduate School of Engineering, Chiba University, Japan
Theme: Volumetric display containing multiple 2D images
Advisor: Professor Tomoyoshi Ito |
| Apr. 2012 – Mar. 2014 | Master of Engineering
Graduate School of Engineering, Chiba University, Japan |
| Apr. 2008 – Mar. 2012 | Bachelor of Engineering
Faculty of Engineering, Chiba University, Japan |

Experiences

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| Apr. 2018 – present | Visiting Research Fellow
Department of Informatics, University of Sussex, UK
Mentor: Prof Sriram Subramanian |
| Apr. 2018 – present | Research Fellow of the Japan Society for the Promotion of Science (PD)
Faculty of Industrial Science and Technology, Tokyo University of Science, Japan
Advisor: Professor Nobuyuki Masuda |
| Apr. 2017 – Mar. 2018 | Research Fellow of the Japan Society for the Promotion of Science (PD)
Graduate School of Engineering, Chiba University, Japan
Advisor: Professor Tomoyoshi Ito |
| Apr. 2015 – Mar. 2017 | Research Fellow of the Japan Society for the Promotion of Science (DC2)
Graduate School of Engineering, Chiba University, Japan
Advisor: Professor Tomoyoshi Ito |
| Nov. 2014 – Mar. 2015 | Research Assistant of the ImPACT Program
Graduate School of Engineering, Chiba University, Japan
Theme: Acceleration of a cell searching algorithm for the Serendipiter
Project Leader: Professor Tomoyoshi Shimobaba |
| Oct. 2014 – Mar. 2015 | Teaching Assistant
Faculty of Engineering, Chiba University
Lecture: Experiment of electrical and electronics engineering III |
| July 2013 – Oct. 2014 | Student Assistant
Academic Link Center, Chiba University
Job: Learning support for undergraduate students |

Journal Papers

1. T. Kakue, Y. Wagatsuma, S. Yamada, Y. Endo, Y. Nagahama, **R. Hirayama**, T. Shimobaba, and T. Ito, "Review of real-time reconstruction techniques for aerial-projection holographic displays," *Optical Engineering* **57**(6), 061621 (2018).
2. T. Sugie, T. Akamatsu, T. Nishitsuji, **R. Hirayama**, N. Masuda, H. Nakayama, Y. Ichihashi, A. Shiraki, M. Oikawa, N. Takada, Y. Endo, T. Kakue, T. Shimobaba, and T. Ito, "High-performance parallel computing for next-generation holographic imaging," *Nature Electronics* **1**, 254–259 (2018).
3. T. Shimobaba, Y. Endo, T. Nishitsuji, T. Takahashi, Y. Nagahama, S. Hasegawa, M. Sano, **R. Hirayama**, T. Kakue, A. Shiraki, and T. Ito, "Computational ghost imaging using deep learning," *Optics Communications* **413**, 147–151 (2018).
4. T. Shimobaba, K. Matsushima, T. Takahashi, Y. Nagahama, S. Hasegawa, M. Sano, **R. Hirayama**, T. Kakue, and T. Ito, "Fast, large-scale hologram calculation in wavelet domain," *Optics Communications* **412**, 80–84 (2018).
5. A. Shiraki, M. Ikeda, H. Nakayama, **R. Hirayama**, T. Kakue, T. Shimobaba, and T. Ito, "Efficient method for fabricating a directional volumetric display using strings displaying multiple images," *Applied Optics* **57**(1), A33–A38 (2018).
6. T. Shimobaba, N. Kuwata, M. Honma, T. Takahashi, Y. Nagahama, M. Sano, S. Hasegawa, **R. Hirayama**, T. Kakue, A. Shiraki, N. Takada, and T. Ito, "Convolutional neural network-based data page classification for holographic memory," *Applied Optics* **56**(26), 7327–7330 (2017).
7. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "Operating scheme of a light-emitting diode array for a volumetric display exhibiting multiple full-color dynamic images," *Optical Engineering* **56**(7), 073108 (2017).
8. **R. Hirayama**, T. Suzuki, T. Shimobaba, A. Shiraki, M. Naruse, H. Nakayama, T. Kakue, and T. Ito, "Inkjet printing-based volumetric display projecting multiple full-colour 2D patterns," *Scientific Reports* **7**, 46511 (2017).
9. T. Shimobaba, Y. Endo, **R. Hirayama**, Y. Nagahama, T. Takahashi, T. Nishitsuji, T. Kakue, A. Shiraki, N. Takada, N. Masuda, and T. Ito, "Autoencoder-based holographic image restoration," *Applied Optics* **56**(13), F27–F30 (2017).
10. T. Shimobaba, Y. Endo, **R. Hirayama**, D. Hiyama, Y. Nagahama, S. Hasegawa, M. Sano, T. Takahashi, T. Kakue, M. Oikawa, and T. Ito, "Holographic micro-information hiding," *Applied Optics* **56**(4), 833–837 (2017).
11. **R. Hirayama**, A. Shiraki, M. Naruse, S. Nakamura, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "Optical Addressing of Multi-Colour Photochromic Material Mixture for Volumetric Display," *Scientific Reports* **6**, 31543 (2016).
12. T. Shimobaba, M. Makowski, Y. Nagahama, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, M. Sano, T. Kakue, M. Oikawa, T. Sugie, N. Takada, and T. Ito, "Color computer-generated hologram generation using the random phase-free method and color space conversion," *Applied Optics* **55**(15), 4159–4165 (2016).
13. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Image quality improvement for a 3D structure exhibiting multiple 2D patterns and its implementation," *Optics Express* **24**(7), 7319–7327 (2016).
14. T. Sanpei, T. Shimobaba, T. Kakue, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, M. Sano, M. Oikawa, T. Sugie, and T. Ito, "Optical encryption for large-sized images," *Optics Communications* **361**, 138–142 (2016).
15. T. Shimobaba, T. Kakue, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, M. Sano, M. Oikawa, T. Sugie, and T. Ito, "Improvement of the image quality of random phase-free holography using an iterative method," *Optics Communications* **355**, 596–601 (2015).
16. T. Shimobaba, T. Kakue, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, M. Sano, M. Oikawa, T. Sugie, and T. Ito, "Random phase-free kinoform for large objects," *Optics Express* **23**(13), 17269–17274 (2015).
17. **R. Hirayama**, M. Naruse, H. Nakayama, N. Tate, A. Shiraki, T. Kakue, T. Shimobaba, M. Ohtsu, and T. Ito, "Design, implementation and characterization of a quantum-dot-based volumetric display," *Scientific Reports* **5**, 8472 (2015), *highlighted in Nature Japan*

18. D. Arai, T. Shimobaba, K. Murano, Y. Endo, **R. Hirayama**, D. Hiyama, T. Kakue, and T. Ito, “Acceleration of computer-generated hologram using tilted wavefront recording plane method,” *Optics Express* **23**(2), 1740–1747 (2015).
19. T. Shimobaba, M. Makowski, T. Kakue, N. Okada, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, and T. Ito, “Numerical investigation of lensless zoomable holographic projection to multiple tilted planes,” *Optics Communications* **333**, 274–280 (2014).
20. T. Shimobaba, T. Kakue, N. Okada, Y. Endo, **R. Hirayama**, D. Hiyama, and T. Ito, “Ptychography by changing the area of probe light and scaled ptychography,” *Optics Communications* **331**, 189–193 (2014).
21. T. Shimobaba, T. Kakue, M. Oikawa, N. Takada, N. Okada, Y. Endo, **R. Hirayama**, and T. Ito, “Calculation reduction method for color computer-generated hologram using color space conversion,” *Optical Engineering*, **53**(2), 024108 (2014).
22. T. Shimobaba, T. Kakue, M. Oikawa, N. Okada, Y. Endo, **R. Hirayama**, N. Masuda, and T. Ito, “Non-uniform sampled scalar diffraction calculation using non-uniform fast Fourier transform,” *Optics Letters* **38**(23), 5130–5133 (2013).
23. T. Shimobaba, M. Makowski, T. Kakue, M. Oikawa, N. Okada, Y. Endo, **R. Hirayama**, N. Masuda, and T. Ito, “Lensless zoomable holographic projection using scaled Fresnel diffraction,” *Optics Express* **21**(21), 25285–25290 (2013).
24. T. Shimobaba, H. Yamanashi, T. Kakue, M. Oikawa, N. Okada, Y. Endo, **R. Hirayama**, and T. Ito, “Inline digital holographic microscopy using a consumer scanner,” *Scientific Reports* **3**, 2664 (2013).
25. H. Nakayama, A. Shiraki, **R. Hirayama**, N. Masuda, T. Shimobaba, and T. Ito, “Three-dimensional volume containing multiple two-dimensional information patterns,” *Scientific Reports* **3**, 1931 (2013).

Presentations

1. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, “Controllable color particles in a 3D crystal projecting multiple dynamic full-color images,” *ACM SIGGRAPH 2017 Posters*, 73, Los Angeles, USA (July 2017).
2. **R. Hirayama**, T. Suzuki, T. Shimobaba, A. Shiraki, M. Naruse, H. Nakayama, T. Kakue, and T. Ito, “Inkjet-printed 3D structure projecting multiple full-color images,” *OPIC IP2017, IP-20AM-1-5*, Yokohama, Japan (Apr. 2017).
3. F. Kawashima, **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito “Gradation expression by overlap of voxels in volumetric display composed of photochromic materials,” *IDW / AD 2016, 3DSAp2/3Dp2-1*, Fukuoka, Japan (Dec. 2016).
4. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, “3-D crystal with a curved surface projecting multiple 2-D images,” *ACM SIGGRAPH Asia 2016 Posters*, 41, Macao, China (Dec. 2016).
5. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, “Refraction-compensating algorithm for a 3D glass structure exhibiting multiple 2D images,” *FiO / LS 2016, JTh2A-68*, Rochester, USA (Oct. 2016).
6. M. Oikawa, D. Hiyama, **R. Hirayama**, S. Hasegawa, Y. Endo, T. Sugie, N. Tsumura, M. Kuroshima, M. Maki, G. Okada, C. Lei, Y. Ozeki, K. Goda, and T. Shimobaba, “A computational approach to real-time image processing for serial time-encoded amplified microscopy,” *SPIE Photonics West BIOS 2016 (Proc. SPIE 9720)*, 97200E, San Francisco USA (Mar. 2016).
7. (invited) A. Shiraki, H. Nakayama, **R. Hirayama**, T. Kakue, T. Shimobaba, and T. Ito, “Volumetric display containing multiple two dimensional information patterns,” *IDW 2015, PRJ1-1*, Otsu, Japan (Dec. 2015).
8. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, “3-D crystal exhibiting multiple 2-D images with directivity,” *ACM SIGGRAPH Asia 2015 Posters*, 1, Kobe, Japan (Nov. 2015).
9. (invited) **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, “3-D crystal exhibiting multiple 2-D images with directivity,” *VRCAI 2015*, 33, Kobe, Japan (Oct. 2015).
10. **R. Hirayama**, A. Shiraki, M. Naruse, H. Nakayama, N. Tate, T. Kakue, T. Shimobaba, and T. Ito, “Optically controlled quantum-dot-based volumetric display exhibiting multiple patterns,” *JSAP-OSA Joint Symposia 2015*, 15p-2F-10, Nagoya, Japan (Sep. 2015).

11. **(invited) R. Hirayama**, M. Naruse, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Optically controlled volumetric display exhibiting multiple two-dimensional patterns," CC3DMR 2015, 340–341, Busan, South Korea (June 2015).
12. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Development of volumetric display based on multi-bit color LED," APCCAS 2014, 547–550, Okinawa, Japan (Nov. 2014).
13. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Volumetric display containing multiple two-dimensional color motion pictures," SPIE DSS 2014 (Proc. SPIE 9117), 911717, Baltimore, USA (May 2014).
14. (invited) T. Kakue, N. Masuda, Y. Endo, **R. Hirayama**, N. Okada, T. Shimobaba, and T. Ito, "Special-purpose computer for real-time reconstruction of holographic motion picture," OIT 2013 (Proc. SPIE 9042), 90420B, Beijing, China (Nov. 2013).
15. **R. Hirayama**, R. Omura, Y. Kobayashi, A. Shiraki, H. Nakayama, T. Kakue, N. Masuda, T. Shimobaba, and T. Ito, "Development of a digitized volumetric display containing multiple two-dimensional patterns," 3DSA 2013, P7-2, Osaka, Japan (June 2013).
16. **R. Hirayama**, H. Ando, A. Shiraki, H. Nakayama, T. Kakue, N. Masuda, T. Shimobaba, and T. Ito, "Image-quality improvement of multiple two-dimensional patterns contained in three-dimensional volume," 3DSA 2013, S11-1, Osaka, Japan (June 2013).
17. **R. Hirayama**, T. Shimobaba, H. Nakayama, A. Shiraki, T. Kakue, N. Masuda, and T. Ito, "Optical encryption using three-dimensional volume containing multiple two-dimensional information patterns," DHIP 2012, C015, Tokushima, Japan (Sep. 2012).

Media

1. **R. Hirayama**, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Optical addressing method for full-color 3D display," SPIE Newsroom (2016).

Grants and Awards

Feb. 2018	Inoue Research Award for Young Scientists Inoue Foundation for Science
Jan. 2018	Young Researcher Award Kenjiro Takayanagi Foundation 2,000,000 JPY
Mar. 2017	President Award for the Excellent Record Chiba University
Mar. 2017	Dean Award for the Excellent Record Graduate School of Engineering, Chiba University
Dec. 2017	GP Program to Support Sending Graduate Students Abroad Institute for Global Prominent Research, Chiba University 136,000 JPY
Oct. 2017	Program to Support Sending Graduate Students Abroad Chiba University 136,000 JPY
Apr. 2016 – present	Grant-in-Aid for JSPS Fellows, No. 16J30007 Japan Society for the Promotion of Science 2,300,000 JPY / 2 years
Mar. 2016	JSPS Ikushi Prize Japan Society for the Promotion of Science
June 2015	KONICA MINOLTA Science and Technology Foundation Award The Optical Society of Japan 50,000 JPY

May 2015	Scholarship Loan Forgiveness for Academic Excellence (Full Amount) Japan Student Services Organization
Mar. 2015	Best Poster Award (FORUM 8 Award) Computer Graphic Arts Society
Jan. 2015	Outstanding Paper Award for Young C&C Researchers NEC C&C Foundation
Apr. 2015 – Mar. 2016	Grant-in-Aid for JSPS Fellows, No. 15J07684 Japan Society for the Promotion of Science 1,200,000 JPY / 2 years
May 2014	Scholarship Loan Forgiveness for Academic Excellence (Full Amount) Japan Student Services Organization
Apr. 2014	Program to Support Sending Graduate Students Abroad Chiba University 150,000 JPY
Apr. 2014	Grants for Researchers Attending International Conferences NEC C&C Foundation 200,000 JPY
Mar. 2014	President Award for the Excellent Record Chiba University
Mar. 2014	Dean Award for the Excellent Record Graduate School of Engineering, Chiba University

Membership

Oct. 2016 – present	Association for Computing Machinery (ACM)
Aug. 2016 – present	The Optical Society (OSA)
Jan. 2014 – present	The Japan Society of Applied Physics (JSAP)

Skills

Programming

C, C++, Python, CUDA, Matlab, VHDL, HTML/CSS

Others

3D printer, Laser cutter, FPGA design, GPU computing, Microcomputer, Photoluminescence materials, Photochromic materials, Illustrator, LaTeX, Maya