

# Ryuji Hirayama

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<https://ryujihirayama.github.io/web/>

## Research Interests

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

## Experiences

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

## Journal Papers

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1. 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).
2. 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).
3. 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).
4. 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).
5. **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).
6. **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).
7. 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).
8. 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).
9. **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).
10. 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).
11. **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).
12. 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).
13. 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).
14. 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).
15. **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*
16. 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).
17. 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).
18. 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).

19. 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).
20. 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).
21. 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).
22. 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).
23. 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

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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

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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

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Feb. 2018	<b>Inoue Research Award for Young Scientists</b> Inoue Foundation for Science
Jan. 2018	<b>Young Researcher Award</b> Kenjiro Takayanagi Foundation 2,000,000 JPY
Mar. 2017	<b>President Award for the Excellent Record</b> Chiba University
Mar. 2017	<b>Dean Award for the Excellent Record</b> Graduate School of Engineering, Chiba University
Dec. 2017	<b>GP Program to Support Sending Graduate Students Abroad</b> Institute for Global Prominent Research, Chiba University 136,000 JPY
Oct. 2017	<b>Program to Support Sending Graduate Students Abroad</b> Chiba University 136,000 JPY
Apr. 2016 – present	<b>Grant-in-Aid for JSPS Fellows, No. 16J30007</b> Japan Society for the Promotion of Science 2,300,000 JPY / 2 years
Mar. 2016	<b>JSPS Ikushi Prize</b> Japan Society for the Promotion of Science
June 2015	<b>KONICA MINOLTA Science and Technology Foundation Award</b> The Optical Society of Japan 50,000 JPY
May 2015	<b>Scholarship Loan Forgiveness for Academic Excellence (Full Amount)</b> Japan Student Services Organization
Mar. 2015	<b>Best Poster Award (FORUM 8 Award)</b> Computer Graphic Arts Society
Jan. 2015	<b>Outstanding Paper Award for Young C&amp;C Researchers</b> NEC C&C Foundation
Apr. 2015 – Mar. 2016	<b>Grant-in-Aid for JSPS Fellows, No. 15J07684</b> Japan Society for the Promotion of Science

	1,200,000 JPY / 2 years
May 2014	<b>Scholarship Loan Forgiveness for Academic Excellence (Full Amount)</b> Japan Student Services Organization
Apr. 2014	<b>Program to Support Sending Graduate Students Abroad</b> Chiba University 150,000 JPY
Apr. 2014	<b>Grants for Researchers Attending International Conferences</b> NEC C&C Foundation 200,000 JPY
Mar. 2014	<b>President Award for the Excellent Record</b> Chiba University
Mar. 2014	<b>Dean Award for the Excellent Record</b> Graduate School of Engineering, Chiba University

## Membership

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

## Skills

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### 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