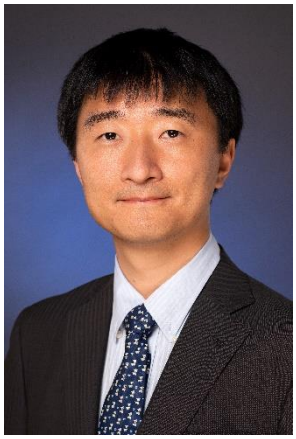
# Akira Ozawa



Date of birth: 3 October 1981, Japanese

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## Research Interest

- High-precision spectroscopy for fundamental physics
- Laser development for optical frequency metrology
- Ion trapping for precision spectroscopy and quantum optics applications

## Education

**Dr. rer. nat. (German Ph.D. equivalent)** **2006 – 2009**
Ludwig Maximilian University of Munich
Max Planck Institute of Quantum Optics, Germany

Thesis Title: “Frequency combs in the extreme ultraviolet”
Grade: summa cum laude
Supervisor: Prof. T.W. Hänsch

**Master of Science in Physics** **2004 – 2006**
Department of Physics, The University of Tokyo, Japan

Thesis Title: “Ultrafast spectroscopy of J-aggregates”
Supervisor: Prof. T. Kobayashi

**Bachelor of Science in Physics** **2000 – 2004**
Department of Physics, The University of Tokyo, Japan

## Research Experience

**Research fellow** **2014 – present**
Laser spectroscopy division (Prof. T.W. Hänsch)
Max Planck Institute of Quantum Optics, Germany

**Assistant professor** (“Jokyo” in Japanese) **2010 – 2014**
Laser and Synchrotron Research Center (Prof. Y.Kobayashi)
The Institute for Solid State Physics, The University of Tokyo, Japan

## Publication Statistics

45 publications in peer-reviewed journals and 4 monographs.
Among them, I am the first or the last author in 24 publications.
Google Scholar citation profile: h-index: 24, i10-index: 31, 2,297 citations.

## Teaching Experience

**Lectures for graduate students** **2021 - present**

Ludwig Maximilian University of Munich and Technical University of Munich

| | |
|---|---|
| "Laser Physics and Atomic Spectroscopy" | Winter Semester 2023 |
| "Atomic Spectroscopy" | Winter Semester 2022 |
| "Quantum Optics" | Winter Semester 2021 |

**Supervision of 5 bachelors, 6 masters and 3 Ph.D. students** **2014 - present**

Max Planck Institute of Quantum Optics

**Supervision of 5 masters and 2 Ph.D. students** (with Prof. Y. Kobayashi) **2010 - 2014**

The University of Tokyo

**Graduate Teaching Assistant** **2004 - 2006**

The University of Tokyo

## Grants

**German Research Foundation, MCQST Seed Funding, EXC-2111**

"Experimental and numerical investigations on low-noise XUV frequency comb generation"
50k € (2021-2022), Principal Investigator

**European technology access centre, ACTPHAST4R**

"Development of hollow core waveguides for extreme ultraviolet wavelengths"
60k € (2022-2023), Principal Investigator

**German Research Foundation, MCQST Seed Funding, EXC-2111**

"Optical frequency combs at a very low repetition rate"
50k € (2022-2023), Principal Investigator

**European technology access centre, ACTPHAST4R Innovation project** (2023)

**German Research Foundation, MCQST Seed Funding, EXC-2111**

"XUV frequency combs on microchip"
50k € (2024), Principal Investigator

**German Research Foundation, Research Grants Programme**

"Testing Quantum Electrodynamics with Lithium Ions"
335k € (2024), Principal Investigator

## Patents

**Generating laser pulses and spectroscopy using the temporal talbot effect**
US patent US20180233877
Th. Udem and A. Ozawa

**Spectral apparatus, detection apparatus, light source apparatus, reaction apparatus, and measurement apparatus**
US patent US9594253B2
Takashi Sukegawa, Yohei Kobayashi, Akira Ozawa, Mamoru Endo, Makoto Gonokami

## Selected Conference Presentations

**Extreme ultraviolet optical frequency combs and applications (invited)**
26th International Conference on Spectral Line Shapes, Otsu-city, Japan (2024)

**Towards High-Precision Spectroscopy of the 1S–2S Transition in $He^+$ (invited)**
7th European Conference on Trapped Ions (ECTI), Bückeburg, Germany (2023)

**Ultra-low repetition rate frequency comb for precision spectroscopy**
Postdeadline Session, CLEO Europe, Munich, Germany (2023)

**Towards High-Precision Spectroscopy of the 1S–2S Transition in $He^+$ (invited)**
Proton Radius European Network Workshop (PREN), Paris, France (2022)

**Towards High-Precision Spectroscopy of the 1S–2S Transition in $He^+$ (invited)**
International Conference on Precision Physics of Simple Atomic Systems (PSAS), Warsaw, Poland (2022)

**Towards high-precision spectroscopy of $He^+$ using extreme-ultraviolet frequency combs (invited)**
2nd International Symposium on Precision Measurement Physics (ISPMP), Wuhan, China (2022)

**Direct comb spectroscopy by quantum-Zeno-effect assisted detection**
Postdeadline Session, CLEO Europe, Munich, Germany (2017)

**VUV Frequency Comb Generation and its Applications (invited)**
High-Intensity Lasers and High-Field Phenomena (HILAS), Berlin, Germany (2014)

**Intracavity High Harmonic Generation At 80 and 10 MHz Repetition Rates (Selected as "Best Paper Awards")**
CLEO-PR, Kyoto, Japan (2013)

**VUV frequency comb generation based on Yb-doped fiber lasers and its application for comb spectroscopy (invited)**
Ultrafast Optics, Davos, Switzerland (2013)

**Single comb mode excitation of ground state xenon in VUV**
Postdeadline Session II, CLEO, San Jose, USA (2012)

**XUV frequency combs (Invited)**
SPIE International Symposium, Photonics Europe, Brussels, Belgium (2010)

**Current Progress in XUV frequency combs (invited)**
2nd International Conference on Attosecond Physics, Manhattan, KS, USA (2009)

**High Harmonic Frequency Combs for High Resolution Spectroscopy**
16th International Conference on Ultrafast Phenomena, Stresa, Italy (2008)

## Awards

**The Japan Society of Applied Physics, The 33rd Autumn Meeting, 2012**
**Young scientist presentation award**
*High precision spectroscopy using vacuum ultraviolet frequency combs*
Akira Ozawa, Yohei Kobayashi

**CLEO-PR&OECC/PS 2013 Best Paper Awards**
*Intracavity High Harmonic Generation At 80 and 10 MHz Repetition Rates*
Akira Ozawa, Makoto Kuwata-Gonokami and Yohei Kobayashi

## Referee Activities

Applied Physics B, Applied Physics Letters, Optics Express, Optics Letters, Optics Communications, Applied Physics Express, Japanese Journal of Applied Physics, The European Physical Journal Plus, Nature Communications, Nature Physics, Nature Photonics, Physics Letters A, and others.

## Publication List

**49. Astigmatic thermal lensing due to surface bulging in Yb:KYW laser crystals**
M. Bieringer, J. Weitenberg, Th. Udem, A. Ozawa
Opt. Mater. Express 14, 2527 (2024)

**48. An ultra-stable high-power optical frequency comb**
Fabian Schmid,Jorge Moreno,Johannes Weitenberg,Peter Russbüldt,Theodor W. Hänsch,Thomas Udem and Akira Ozawa
APL Photonics 9, 026105 (2024)
*Selected as "Editor's Pick"*

**47. A low repetition rate optical frequency comb**
Francesco Canella, Johannes Weitenberg, Muhammad Thariq, Fabian Schmid, Paras Dwivedi, Gianluca Galzerano, Theodor Haensch, Thomas Udem, and Akira Ozawa
Optica, 11, 1 (2024)

**46. Toward XUV frequency comb spectroscopy of the 1 S–2 S transition in He+**
Jorge Moreno, Fabian Schmid, Johannes Weitenberg, Savely G. Karshenboim, Theodor W. Hänsch, Thomas Udem and Akira Ozawa
Eur. Phys. J. D 77, 67 (2023)

**45. Number-Resolved Detection of Dark Ions in Coulomb Crystals**
Fabian Schmid, Johannes Weitenberg, Jorge Moreno, Theodor W. Hänsch, Thomas Udem, and Akira Ozawa
Phys. Rev. A 106, L041101 (2022)

**44. The Complete $\alpha^8 m$ Contributions to the 1s Lamb Shift in Hydrogen**
S. G. Karshenboim, A. Ozawa, V. A. Shelyuto, E. Yu. Korzinin, R. Szafron, and V. G. Ivanov
Physics of Particles and Nuclei 53, 773 (2022)

**43. Very large bandwidth lasers**
Akira Ozawa. and Thomas Udem
Nature Photonics 15, 247 (2021)

**42. Higher-order logarithmic corrections and the two-loop self-energy of a 1s electron in hydrogen**
Savely G. Karshenboim, Akira Ozawa, and Vladimir G. Ivanov
Phys. Rev. A 100, 032515 (2019)

**41. The Lamb shift of the 1s state in hydrogen: Two-loop and three-loop contributions**
Savely G. Karshenboim, Akira Ozawa, Valery A. Shelyuto, Robert Szafron, Vladimir G. Ivanov
Phys. Lett. B, 795, 432 (2019)

**40. Simple phase noise measurement scheme for cavity-stabilized laser systems**
Fabian Schmid, Johannes Weitenberg, Theodor W. Hänsch, Thomas Udem, and Akira Ozawa
Opt. Lett. 44, 2709 (2019)

**39. Motional resonances of three-dimensional dual-species Coulomb crystals**
Byoung-moo Ann, Fabian Schmid, Jonas Krause, Theodor W Hänsch, Thomas Udem and Akira Ozawa
J. Phys. B: At. Mol. Opt. Phys. 52, 035002 (2019)

**38. Quantum Zeno Effect assisted Spectroscopy of a single trapped Ion**
Akira Ozawa, Josue Davila-Rodriguez, Theodor W. Hänsch and Thomas Udem
Scientific Reports, 8, 10643 (2018)

**37. Efficient high harmonics generation by enhancement cavity driven with a post-compressed FCPA laser at 10 MHz**
Zhigang Zhao, Akira Ozawa, Makoto Kuwata-Gonokami and Yohei Kobayashi
High Power Laser Science and Engineering, 6, E19 (2018)

**36. Multi-pass-cell-based nonlinear pulse compression to 115 fs at 7.5 µJ pulse energy and 300 W average power**
Johannes Weitenberg, Andreas Vernaleken, Jan Schulte, Akira Ozawa, Thomas Sartorius, Vladimir Pervak, Hans-Dieter Hoffmann, Thomas Udem, Peter Russbüldt, and Theodor W. Hänsch
Opt. Express, 25, 20502 (2017)

**35. Single ion fluorescence excited with a single mode of an UV frequency comb**
Akira Ozawa, Josue Davila-Rodriguez, James R. Bounds, Hans A. Schuessler, Theodor W. Hänsch and Thomas Udem
Nature Communications, 8, 44 (2017)

**34. Mode locking based on the temporal Talbot effect**
Thomas Udem and Akira Ozawa
Appl. Phys. B 123: 100 (2017)

**33. High repetition pump-and-probe photoemission spectroscopy based on a compact fiber laser system**
Y. Ishida, T. Otsu, A. Ozawa, K. Yaji, S. Tani, S. Shin and Y. Kobayashi
Rev. Sci. Instrum. 87, 123902 (2016)

**32. Doppler Cooling Trapped Ions with a UV Frequency Comb**
Josue Davila-Rodriguez, Akira Ozawa, Theodor W. Hänsch, and Thomas Udem
Physical Review Letters, 116, 043002 (2016)

**31. High average power coherent vuv generation at 10 MHz repetition frequency by intracavity high harmonic generation (Selected as Spotlight on Optics, Highlighted Articles from OSA Journals)**
Akira Ozawa, Zhigang Zhao, Makoto Kuwata-Gonokami, and Yohei Kobayashi
Optics Express, Vol. 23, Issue 12, pp. 15107-15118 (2015)

**30. Dual comb spectroscopy (in Japanese)**
Naoya Kuse, Akira Ozawa, Yohei Kobayashi
Journal of the Physical Society of Japan, 69, 1 (2014)

**29. 6-GHz, Kerr-lens mode-locked Yb:Lu2O3 ceramic laser for comb-resolved broadband spectroscopy**
Mamoru Endo, Akira Ozawa and Yohei Kobayashi
Optics Letters, Vol. 38 Issue 21, pp. 4502 (2013)

**28. VUV frequency comb generation and its application to high precision spectroscopy (in Japanese)**
Akira Ozawa and Yohei Kobayashi
OplusE Oct. (2013)

**27. 10-MHz, Yb-fiber chirped-pulse amplifier system with large-scale transmission gratings**
Yohei Kobayashi, Nozomi Hirayama, Akira Ozawa, Takashi Sukegawa, Takashi Seki, Yoshiyuki Kuramoto and Shuntaro Watanabe,
Optics Express Vol. 21, Issue 10, pp. 12865–12873 (2013)

**26. Static FBG strain sensor with high resolution and large dynamic range by dual-comb spectroscopy**
Kuse, Naoya; Ozawa, Akira; Kobayashi, Yohei,
Optics Express, Vol. 21 Issue 9, pp.11141-11149 (2013)

**25. Vuv frequency-comb spectroscopy of atomic xenon**
Akira Ozawa and Yohei Kobayashi
Phys. Rev. A 87, 022507 (2013)

**24. Vacuum ultraviolet frequency comb generation and applications (in Japanese)**
Akira Ozawa and Yohei Kobayashi
Japanese journal of optics, 41,9 (2012)

**23. Comb-Resolved Dual-Comb Spectroscopy Stabilized by Free-Running Continuous-Wave Lasers**
Naoya Kuse, Akira Ozawa Yohei Kobayashi,
Appl. Phys. Exp 5, 112402 (2012)

**22. Chirped-pulse direct frequency-comb spectroscopy of two-photon transitions**
Akira Ozawa and Yohei Kobayashi
Phys. Rev. A 86, 022514 (2012)

**21. Kerr-lens mode-locked Yb:KYW laser at 4.6-GHz repetition rate**
M. Endo, A. Ozawa and Y. Kobayashi
Optics Express 20 12191-12197 (2012)

**20. Injection locking of Yb-fiber based optical frequency comb**
Naoya Kuse, Akira Ozawa, Yutaka Nomura, Isao Ito, Yohei Kobayashi
Optics Express 20 10509-10518 (2012)

**19. Vacuum ultraviolet frequency combs generated by a femtosecond enhancement cavity in the visible**
Birgitta Bernhardt, Akira Ozawa, Andreas Vernaleken, Ioachim Pupeza, Jan Kaster, Yohei Kobayashi,
Ronald Holzwarth, Ernst Fill, Ferenc Krausz, Theodor W. Hänsch, and Thomas Udem
OPTICS LETTERS 37 503-505 (2012)

**18. Coherent quasi-cw 153 nm light source at 33 MHz repetition rate**
Yutaka Nomura, Yoshiaki Ito, Akira Ozawa, Xiaoyang Wang, Chuangtian Chen, Shik Shin,
Shuntaro Watanabe, and Yohei Kobayashi
Optics Letters 36 1758-1760 (2011)

**17. Interferometric autocorrelation in the ultraviolet utilizing spontaneous parametric down-conversion inside an enhancement cavity**
P. Michelberger, R. Krischek, W. Wieczorek, A. Ozawa, and H. Weinfurter
Optics Letters 37 1223-1225 (2012)

**16. Power scaling of femtosecond enhancement cavities and high-power applications**
I. Pupeza , T. Eidam, J. M. Kaster, B. Bernhardt, J. Rauschenberger, A. Ozawa, E. Fill , Th. Udem, M. F. Kling ,
J. Limpert, Z. Alahmed, A. M. Azzeer, A. Tünnermann, Th. W. Hänsch, and F. Krausz
SPIE professional 7914, 79141I-1 (2011)

**15. Carrier-envelope phase-locked pump-probe experiment for independent phase/delay manipulation**
Shunsuke Adachi, Akira Ozawa, Takayoshi Kobayashi
Chemical Physics Letters 489 130–133 (2010)

**14. Self-compensation of third-order dispersion for ultrashort pulse generation demonstrated in an Yb fiber oscillator**
Naoya Kuse, Yutaka Nomura, Akira Ozawa, Makoto Kuwata-Gonokami, Shuntaro Watanabe, and Yohei Kobayashi
Optics Letters, 35 3868-3870 (2010)

**13. Modeling and optimization of single-pass laser amplifiers for high-repetition-rate laser pulses**
Akira Ozawa, Thomas Udem, Uwe D. Zeitner, Theodor W. Hänsch, Peter Hommelhoff
PHYSICAL REVIEW A 82 033815 (2010)

**12. Power scaling of a high-repetition-rate enhancement cavity**
Ioachim Pupeza, Tino Eidam, Jens Rauschenberger, Birgitta Bernhardt, Akira Ozawa, Ernst Fill, Alexander Apolonski,
Thomas Udem, Jens Limpert, Zeyad A. Alahmed, Abdallah M. Azzeer, Andreas Tünnermann, Theodor W. Hänsch
and Ferenc Krausz
Optics Letters, Vol. 35, Issue 12, pp. 2052-2054 (2010)

**11. A Peltier Cooled Single Pass Amplifier for Titanium: Sapphire Laser Pulses**
A. Ozawa, W. Schneider, F. Najafi, T.W. Hänsch, Th. Udem, P. Hommelhoff
LASER PHYSICS 20 967 (2010)

**10. Ultraviolet enhancement cavity for ultrafast nonlinear optics and high-rate multiphoton entanglement experiments**
Roland Krischek, Witlef Wieczorek, Akira Ozawa, Nikolai Kiesel, Patrick Michelberger, Thomas Udem
and Harald Weinfurter
Nature Photonics 4, 170 - 173 (2010)

9. **Cavity-enhanced dual-comb spectroscopy**
   Birgitta Bernhardt, Akira Ozawa, Patrick Jacquet, Marion Jacquey, Yohei Kobayashi, Thomas Udem, Ronald Holzwarth, Guy Guelachvili, Theodor W. Hänsch, Nathalie Picqué
   Nature Photonics 4, 55 - 57 (2010)

8. **Efficient 494 mW sum-frequency generation of sodium resonance radiation at 589 nm by using a periodically poled Zn:LiNbO3 ridge waveguide**
   T. Nishikawa, A. Ozawa, Y. Nishida, M. Asobe, F.L. Hong, T.W. Hänsch
   Opt. Express 17 17792 (2009)

7. **Phase-stable single-pass cryogenic amplifier for high repetition rate few-cycle laser pulses**
   A. Ozawa, W. Schneider, T.W. Hänsch, Th. Udem, P. Hommelhoff
   New J. Phys. 11 083029 (2009)

6. **Puzzling spectral structures of molecular vibration observed in ultrafast pump–probe experiment of transparent material**
   Akira Ozawa and Takayoshi Kobayashi
   Chem. Phys. Lett. 477 281 (2009)

5. **Feasibility of coherent xuv spectroscopy on the 1S-2S transition in singly ionized helium**
   M. Herrmann, M. Haas, U.D. Jentschura, F. Kottmann, D. Leibfried, G. Saathoff, C. Gohle, A. Ozawa, V. Batteiger, S. Knünz, N. Kolachevsky, H.A. Schüssler, T.W. Hänsch, Th. Udem
   Phys. Rev. A 79 052505 (2009)

4. **Non-collinear high harmonic generation: A promising outcoupling method for cavity-assisted XUV generation**
   A. Ozawa, A. Vernaleken, W. Schneider, I. Gotlibovych, Th. Udem, T.W. Hänsch
   Opt. Express 16 6233 (2008)

3. **High harmonic frequency combs for high resolution spectroscopy**
   A. Ozawa, J. Rauschenberger, Ch. Gohle, M. Herrmann, D.R. Walker, V. Pervak, A. Fernandez, R. Graf, A. Apolonski, R. Holzwarth, F. Krausz, T.W. Hänsch, Th. Udem
   Phys. Rev. Lett. **100** 253901 (2008)
   *Selected for Virtual Journal of Ultrafast Science, Volume 7, Issue 7*

2. **Time resolution of chirped lattice vibrations in a mixed-valence metal-halogen complex system**
   F. Araoka, A. Ozawa, D. Kawakami, S. Takaishi, M. Yamashita, T. Kobayashi
   Phys. Rev. B 75 224304 (2007)

1. **Sub-5 fs time-resolved dynamic Franck-Condon overlaps associated with the S1 → S0 stimulated transition in oligothiophene 13-mer**
   A. Ozawa, K. Takimiya, T. Otsubo, T. Kobayashi
   Chem. Phys. Lett. 409 224 (2005)