

CURRICULUM VITAE

Alexey Belyanin

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Main Fields of Research

Coherent and ultrafast optical phenomena

Nonlinear optics

Physics of semiconductors, nanostructures, and novel materials

Physics of optoelectronic devices

Quantum optics and electrodynamics

Plasma physics, astrophysics, and cosmology

Education

PhD in Physics from the Institute of Applied Physics of the Russian Academy of Sciences (1995).

M.S. in Physics with honors from Nizhny Novgorod State University (1989).

Appointments

Sept. 2013-present: Professor and Associate Head for Undergraduate Programs,
Department of Physics & Astronomy, Texas A&M University

Sept. 2010-present: Professor, Department of Physics, Texas A&M University

Sept. 2007 – 2010: Associate Professor, Department of Physics, Texas A&M
University

Sept. 2003 – 2007: Assistant Professor, Department of Physics, Texas A&M
University

Sept. 1999 – August 2003: Assistant Research Scientist, Department of Physics,
Texas A&M University

1989-1999: Junior Research Scientist, Research Scientist, Senior Research Scientist,
Institute of Applied Physics of the Russian Academy of Sciences

1992-1999: Part-time faculty at Nizhny Novgorod State University

Awards and Honors

- Ed Rachal Chair, 2022
- Fellow, Optical Society of America (OSA), 2018
- Fellow, International Society for Optics and Photonics (SPIE), 2015
- Fellow, American Physical Society, 2012
- JoAnn Treat Research Excellence Award, 2007
- NSF CAREER Award, 2006

- University of Jena, Abbe School of Photonics Lectureship, 2011
- Lund University Lectureship, 2011
- Russian Academy of Science Award for Outstanding Young Investigators, 1998
- President of Russian Federation Scholarship for Outstanding Young Scientists, 1993-1996
- Open Society Fellowship, 1993-1995

Teaching Experience

- Physics 485 “Cavity QED, nanophotonics, and quantum information”, 2019-2021
- Physics 309 “Modern physics”, Spring 2017, 2018, 2019, 2020, 2023
- Physics 649 “Physics of optoelectronic devices”, Spring 2011, 2015, 2016, 2021
- Physics 302-303 “Advanced Mechanics”, Fall 2011-Spring 2014
- New graduate course Physics 689 “Physics of optoelectronic devices”, Spring 2007, 2008, and 2009
- ASTR 314 “Astrophysics”, Texas A&M University, Spring 2010, Spring 2022
- Physics 218 “Mechanics”, Fall 2007 and 2008, Summer and Fall 2009, Summer 2010 and 2011.
- Physics 306 “Basic Astronomy”, 2004-2006.
- Faculty advisor, Society of Physics Students, TAMU Chapter: Sept. 2006-present. Weekly or bi-weekly meetings with undergraduate physics majors, ~ 10 tutorial lectures per year.
- Physics 219 “Electricity and Magnetism”, 2001.
- “Theoretical Mechanics”, Nizhny Novgorod State University, 1994-1998.
- Public lectures, Nizhny Novgorod State Planetarium, 1994-1999. Over 300 lectures. Over 20 new shows created

Funding

(i) Current grants:

AFOSR: Pico-cavity QED: a new materials platform for room-temperature control of quantum coherence, 2021-2025

NSF: QII – TAQS: Quantum Circuits through Symmetry-driven Valley Optoelectronics, 2019-2024

TAMU: T3 grant, X-grant, STRP grant, Brazil (FAPESP)-TAMU grant.

(ii) Previous grants:

NSF EAGER: Collaborative Research: Electrically Pumped Monolithic Bi-photon emitters, 2021-2022

NSF: Compact room temperature operated THz emitters with scalable architecture and

low electric power consumption, 2017-2020

NSF: Novel quantum cascade laser sources for terahertz sensing, 2018-2021

AFOSR: Nonlinear and THz studies of electro-optic and magneto-electric materials, 2014-2021

ONR: Fully Automated Quantum Cascade Laser Design Aided by Machine Learning with up to 100X Design Cycle Time Reduction, Phase I, 2020.

NSF: Quantum cascade laser sources of high-power, coherent frequency combs, 2016-2019

AFOSR: Nonlinear Optics and Electrodynamics of Systems with Massless Dirac Fermions, 2015-2018

NSF Engineering Research Center: "Mid-infrared Technologies for Health and the Environment (MIRTHE)" 2006-2016

NSF PIRE: "TERANO: Terahertz Dynamics in Nanostructures" 2011-2016

NSF: "Ultrashort pulses and frequency combs from mid-infrared quantum cascade lasers", 2012-2015.

NHARP: "Room-temperature electrically-pumped semiconductor sources of THz radiation 2010-2013"

US Dept. of Education: "FIPSE, United States-Russia Program: Improving Research and Educational Activities in Higher Education" 2010-2015

NSF PIRE: "U.S.-Japan Cooperative Research and Education: Ultrafast and Nonlinear Optics in 6.1-Angstrom Semiconductors" 2006-2011

NSF CAREER: "Active integrated nanostructure devices for infrared photonics and femtosecond pulse generation" 2006-2011

EU grant with Univ. Sheffield: "Exploring Short Wavelength Limits for High Performance Quantum Cascade Lasers" 2010-2013

NSF: "Room-temperature terahertz semiconductor Raman lasers" 2009-2012

AFOSR: "New widely tunable room temperature THz coherent sources", 2005-2008

NSF: New Types of Mid/Far-Infrared Semiconductor Lasers for CW Room-Temperature Operation, 2005-2008

AFOSR: New Mid/Far-Infrared CW Room-Temperature Semiconductor Lasers Based on Intralaser Wave Mixing, 2005-2008

DURIP 2006: Ultrafast imaging system for time-resolved studies and development of high-power mid/far-infrared semiconductor sources
Sponsor: AFOSR, 2006.

Synergistic and Outreach Activities:

Chair of the International Conference “Novel in-plane semiconductor lasers”, held annually within the SPIE Symposium “Photonics West”, 2008-2023.

Co-chair of the International Conference “Infrared and Terahertz Technologies for Health and Environment”, held in 2005-2007 in Boston, MA, within the SPIE Symposium “Optics East”.

Co-organizer, Mitchell Institute Physics Enhancement Program (MIPEP): an intense 2-week summer program for high school physics teachers sponsored by the Mitchell Foundation and Texas A&M University. Every summer since 2012.

Organizer of special sessions at the annual Winter Colloquium on the Physics of Quantum Electronics (PQE), 2003-2007, 2015, 2016, 2019

Program Committee member of the International Semiconductor Laser Conference (ISLC), 2017 and 2018.

Program Committee member of the 36th International conference “Infrared, mm, and THz waves”, October 2011 (Houston).

Program Committee member of the International Quantum Cascade Laser School and Workshop, Cambridge UK, 2016.

Program Committee member of the International Symposium Fundamental & Applied Problems of Terahertz Devices & Technologies, Sendai, Japan 2016.

Faculty advisor for the Society of Physics Students, TAMU Chapter, since 2006.

Review panelist for several NSF programs and other federal agencies: AFOSR, DARPA, ARPA-E, and ARO.

Frequent reviewer of papers submitted to Science, Nature journals, Physical Review Letters, Optics Letters, Nano Letters, Optics Express, ACS Nano, Applied Physics Letters, Physical Review A and B, and many other journals. Reviewer for McArthur Foundation.

Extensive outreach activity. Since 2003: hundreds of lectures and physics demonstrations for K-12 students, school teachers, and general public. Numerous invited lectures, demonstrations, and telescope viewing activities at the outreach programs and events on campus, such as Physics & Engineering Festival, Math Awareness Month, Saturday Morning Physics, International Year of Light, World Year of Physics, Expanding Your Horizons, Society of Hispanic Engineers, Youth Adventure Camp, Davidson Young Scholars, MIPEP, etc. Guest lectures for OSA and SPS Chapters. Some of these lectures are posted on my webpage <http://faculty.physics.tamu.edu/belyanin/education.htm>

Professional Societies:

- American Physical Society, Fellow
- International Society for Optics and Photonics (SPIE), Fellow
- Optical Society of America (OSA), Fellow

Publications:

- Number of papers in peer-reviewed journals: 160
- Reviews and Book Chapters: 8
- 5 US Patents
- Editor of the Proceedings of the International Conferences “Photonics West” (13 volumes) and “Optics East” (SPIE Proc. Vol. 6010 and 6386).
- Media coverage in news articles in Nature, Science, Nature Photonics, Laser Focus World, Optoelectronics Magazine, many online news servers, Aggie Daily News, College of Science News, etc.

Research Supervision:

Postdoctoral researchers:

Aleksander Wojcik: 2007-2013

Yongrui Wang: 2015-2021; now researcher at ASML.

Ashutosh Singh: current

Jitendra Verma: current

Graduate students:

Dmitry Pestov (co-advised with V. Kocharovsky): 2002-2004

Debin Liu: received MS in 2005, went to industry

Feng Xie: received PhD in 2008, became research scientist at Corning (now acquired by Thorlabs)

Venkata Chaganti: received MS in 2008

Don Smith: received PhD in 2013, became research staff at Freescale, now scientist at Avery Dennison

Yonghee Cho: received PhD in 2011, became scientist at Samsung Research
Yongrui Wang received PhD in 2015, became postdoc and then research scientist in my group at TAMU, now research scientist at ASML (leader in chip-making technology)
Xianghan Yao: received PhD in 2014, went to quantitative finance MBA, now at DRW Holdings
A. Ryan Kutayiah, received PhD in 2019, now Assistant Professor at Abilene Christian University
Zhongqu Long, received PhD in 2019, now a researcher at Google
Zicheng Wang, received MS in 2019, now software engineer at SAP
Qianfan Chen, received PhD in August 2021, now a postdoc jointly between Argonne National Lab and University of Chicago
Sultan Almutairi, 2016- 2021. Now research scientist at KAIST.
Maria Sebastian: 2022-current
Adel Ali: 2023-current

PUBLICATIONS

Book Chapters:

1. A. Belyanin, F. Capasso, and M. Troccoli, Raman injection and inversionless intersubband lasers, Chapter 6, in: *Intersubband Transitions in Quantum Structures*, ed. by R. Paiella, McGraw-Hill, 2006, 181-236.
2. C. Gmachl, O. Malis, and A. Belyanin, Optical Nonlinearities in Intersubband Transitions and Quantum Cascade Lasers, Chapter 5, in: *Intersubband Transitions in Quantum Structures*, ed. by R. Paiella, McGraw-Hill, 2006, 237-284.
3. A. Belyanin, G.R. Welch, and M.O. Scully, Atomic Coherence Phenomena, in: *Encyclopedia of Modern Optics*, edited by Robert D. Guenther, Duncan G. Steel and Leopold Bayvel, Elsevier, Oxford, 2004, ISBN 0-12-227600-0, 247-255.

Patents:

1. Infrared generation in semiconductor lasers. Scully M.O., Belyanin A.A., Kocharovskiy V.V., U.S. Patent granted on August 24, 2004 (No. 6,782,020).
2. Detecting infrared radiation. Boyd R.W., Haden C.R., Scully M.O., Belyanin A.A., Kocharovskiy V.V., U.S. Patent Granted on May 4 2004 (Patent No. 6,730,910).
3. "Phase Matched Parametric Light Generation in Monolithically Integrated Intersubband Optical Devices", A. Belyanin, A.Y. Cho, C. Gmachl, O. Malis, M.L. Peabody, A.M. Sergeant, D.L. Sivco, Patent granted September 6, 2005. (Patent No. 6,940,639).
4. "Raman injection and inversionless lasers", A. Belyanin, F. Capasso, and M. Troccoli, Patent submitted to USPTO, Application 11/027,398.
5. "Method and apparatus for generating terahertz radiation", M. Belkin, F. Capasso, A. Belyanin, Patent No. 7,974,325 (2011).

Publications in peer-reviewed journals:

1. A. Ali and A. Belyanin, Topological nonlocal operations on toroidal flux qubits, Phys. Rev. Lett. submitted; <https://arxiv.org/abs/2312.09471>
2. Yueying Wang, Nishant Nookala, Samuel C. Johnson, John F. Klem, Min Hu, Igal Brener, Eric A. Muller, Alexey Belyanin, Mikhail A. Belkin, Markus B. Raschke, Tip-enhanced imaging and control of infrared strong light-matter interaction, Laser & Photonics Reviews, submitted.
3. W. Luo, R. Song, B. G. Whetten, Di Huang, X. Cheng, A. Belyanin, T. Jiang, and M. B. Raschke, Nonlinear nano-imaging of interlayer coupling in 2D graphene-semiconductor heterostructures, Small, accepted.
4. Jonathan D. Perry, Anne Wang, Carlee Garrett, Matthew Dew, Mary Head, Alexey Belyanin, Bhaskar Dutta, and Tatiana Erukhimova, Mitchell Institute Physics Enhancement Program for High School In-Service Teachers with Low Physics Background, The Physics Teacher, accepted.
5. X. Ju, Z. Hu, G. Zhu, F. Huang, Y. Chen, C. Guo, A. Belyanin, J. Kono, and X. Wang, Creating a near-perfect circularly polarized terahertz beam through the nonreciprocity of a magnetoplasma, [Opt. Express 31, 38540-38549 \(2023\)](#)
6. Dmitry Kazakov, Nikola Opacak, Florian Pilat, Yongrui Wang, Alexey Belyanin, Benedikt Schwarz, and Federico Capasso, Cluster synchronization in a semiconductor laser, APL Photonics, submitted.
7. M. Tokman, J. Verma, J. Bohreer, and A. Belyanin, Maximally efficient generation of entangled photons by single photon decay in integrated photonic circuits, [Phys. Rev. Lett. 131, 233802 \(2023\)](#).
8. A. Singh, M. Sebastian, Y. Chen, Po-Yao Chang, and A. Belyanin, Hyperbolic polaritons in topological nodal ring semimetals, [Phys. Rev. Lett. 131, 096902 \(2023\)](#).
9. M. Tokman, M. Erukhimova, Y. Wang, and A. Belyanin, Coulomb-induced synchronization of intersubband coherences in highly doped quantum wells and the formation of giant collective resonances, [Phys. Rev. B 107, 245403 \(2023\)](#).
10. W. Luo, B. G. Whetten, V. Kravtsov, A. Singh, Y. Yang, Di Huang, X. Cheng, T. Jiang, A. Belyanin, and M. B. Raschke, Ultrafast nanoimaging of electronic coherence of monolayer WSe₂, [Nano Lett. 23, 1767 \(2023\)](#).
11. M. Tokman, A. Behne, B. Torres, M. Erukhimova, Y. Wang, and A. Belyanin, Dissipation-driven formation of entangled dark states in strongly-coupled inhomogeneous many-qubit systems in solid-state nanocavities, [Phys. Rev. A 107, 013721 \(2023\)](#).
12. M. Tokman, M. Erukhimova, Q. Chen, and A. Belyanin, The universal model of strong coupling at the nonlinear parametric resonance in open cavity-QED systems, Phys. Rev. A 105, 053707 (2022). <https://doi.org/10.1103/PhysRevA.105.053707>

13. D. Kazakov, N. Opacak, M. Beiser, A. Belyanin, B. Schwarz, M. Piccardo, and F. Capasso, Defect-engineered ring laser harmonic frequency combs, *Optica* 8, 1277 (2021). <https://www.osapublishing.org/optica/fulltext.cfm?uri=optica-8-10-1277&id=459998>
14. N. Nefedkin, A. Mekawy, J. Krakofsky, Y. Wang, A. Belyanin, M. Belkin, and A. Alu, Overcoming intensity saturation in nonlinear multiple-quantum-well metasurfaces for high-efficiency frequency upconversion, *Adv. Mat.* 2021, 2106902. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/adma.202106902>
15. M. Tokman, Y. Wang, Q. Chen, L. Shterengas, and A. Belyanin, Generation of entangled photons via parametric down-conversion in semiconductor lasers and waveguides, *Phys. Rev. A* 105, 033707 (2022).
16. M. Tokman, Q. Chen, M. Erukhimova, Y. Wang, and A. Belyanin, Quantum dynamics of open many-qubit systems strongly coupled to a quantized electromagnetic field in dissipative cavities, <https://arxiv.org/abs/2105.14674>.
17. J. Jiang, L. Shterengas, G. Kipshidze, A. Stein, A. Belyanin, G. Belenky, High-power narrow spectrum GaSb-based DBR lasers emitting near 2.1 μm , *Opt. Lett.* 46, 1967 (2021). <https://doi.org/10.1364/OL.422536>
18. A. Forrer, Y. Wang, M. Beck, A. Belyanin, J. Faist, and G. Scalari, Self-starting harmonic comb emission in THz quantum cascade lasers, *Appl. Phys. Lett.* 118, 131112 (2021). <https://aip.scitation.org/doi/10.1063/5.0041339>
19. X. Ju, Z. Hu, F. Huang, H. Wu, A. Belyanin, J. Kono, and X. Wang, Tunable ultrasharp terahertz plasma edge in a lightly doped narrow-gap semiconductor, *Opt. Express* 29, 9261 (2021).
20. Q. Chen, Y. Wang, S. Almutairi, M. Erukhimova, M. Tokman, and A. Belyanin, Dynamics and control of entangled electron-photon states in nanophotonic systems with time-variable parameters, *Phys. Rev. A* 103, 013708 (2021). <https://journals.aps.org/prapdf/10.1103/PhysRevA.103.013708>
21. M. May, T. Jiang, C. Du, K.-D. Park, X. Xu, A. Belyanin, and M. Raschke, Nanocavity clock spectroscopy: resolving competing exciton dynamics in WSe₂/MoSe₂ heterobilayers, *Nano Lett.* 21, 522 (2021). <https://pubs.acs.org/doi/10.1021/acs.nanolett.0c03979>
22. M. Tokman, M. Erukhimova, Y. Wang, Q. Chen, and A. Belyanin, Generation and dynamics of entangled fermion-photon-phonon states in nanocavities, *Nanophotonics* 10, 491 (2021). <https://doi.org/10.1515/nanoph-2020-0353>
23. M. Erukhimova, Y. Wang, M. Tokman, and A. Belyanin, Relaxation operator for quasiparticles in a solid, *Phys. Rev. B* 102, 235103 (2020).
24. Y. Wang and A. Belyanin, Harmonic frequency combs in quantum cascade lasers: time-domain and frequency-domain theory, *Phys. Rev. A* 102, 013519 (2020).
25. M. Piccardo, B. Schwarz, D. Kazakov, M. Beiser, N. Opacak, Y. Wang, S. Jha, J. Hillbrand, M. Tamagnone, W.T. Chen, A. Y. Zhu, L. L. Columbo, A. Belyanin, and

- F. Capasso, Frequency combs induced by phase turbulence, [Nature 582, 360 \(2020\)](#).
News & Views: <https://www.nature.com/articles/s41567-020-0945-2>
26. S. Almutairi, Q. Chen, M. Tokman, and A. Belyanin, Four-wave mixing in Weyl semimetals, [Phys. Rev. B. 101, 235156 \(2020\)](#).
 27. I.D. Tokman, Q. Chen, I.A. Shereshevsky, V.I. Pozdnyakova, I. Oladyshkin, M. Tokman, and A. Belyanin, Inverse Faraday effect in graphene and Weyl semimetals, [Phys. Rev. B 101, 174429 \(2020\)](#).
 28. J. Jiang, L. Shterengas, A. Stein, G. Kipshidze, A. Belyanin, G. Belenky, Dual-wavelength Y-branch DBR lasers with 100 mW of CW power near 2 μm , [IEEE Phot. Technology Lett. 32, 1017 \(2020\)](#).
 29. M. K. Alam, C. Niu, Y. Wang, We. Wang, Y. Li, C. Dai, T. Tong, X. Shan, E. Charlson, S. Pei, X.-T. Kong, Y. Hu, A. Belyanin, G. Stein, Z. Liu, J. Hu, Z. Wang, and J. Bao, Large graphene-induced shift of surface-plasmon resonances of gold films: Effective-medium theory for atomically thin materials, [Phys. Rev. Research 2, 013008 \(2020\)](#).
 30. Tao Feng, Leon Shterengas, Takashi Hosoda, Gela Kipshidze, Alexey Belyanin, Chu C. Teng, Jonas Westberg, Gerard Wysocki, and Gregory Belenky, Passively mode-locked 2.7 and 3.2 μm GaSb-based cascade diode lasers, [IEEE/OSA Journal of Lightwave Technology 38, 1895 \(2020\)](#).
 31. Q. Chen, M. Erukhimova, M. Tokman, and A. Belyanin, Optical Hall effect and gyrotropy of surface polaritons in Weyl semimetals, [Phys. Rev. B 100, 235451 \(2019\)](#).
 32. T. Jiang, V. Kravtsov, M. Tokman, A. Belyanin, and M. Raschke, Ultrafast coherent nonlinear nanooptics and nanoimaging of graphene, [Nature Nanotechnology 14, 838 \(2019\)](#). Media article: <https://science.tamu.edu/news/2019/09/texas-am-physicist-alexey-belyanin-sheds-new-light-on-graphenes-properties-and-future-of-nanophotonic-device-design/>
 33. Q. Chen, A. Ryan Kutayiah, I. Oladyshkin, M. Tokman, and A. Belyanin, Optical properties and electromagnetic modes of Weyl semimetals, [Phys. Rev. B 99, 075137 \(2019\)](#).
 34. M. Piccardo, D. Kazakov, B. Schwarz, P. Chevalier, A. Amirzhan, J. Hillbrand, S. Z. AlMutairi, Y. Wang, F. Xie, K. Lascola, S. Becker, L. Hildebrandt, R. Weih, A. Belyanin, and F. Capasso, Light and Microwaves in Laser Frequency Combs: An Interplay of Spatiotemporal Phenomena, *IEEE J. Selected Topics Quant. Electron.* 25 2908553 (2019).
 35. N.N. Elkin, A.P. Napartovich, D.V. Vysotsky, C. Sigler, C.A. Boyle, J.D. Kirch, T. Earles, D. Botez, L.J. Mawst, and A. Belyanin, Analysis of mode competition in resonant leaky-wave coupled phase-locked arrays of mid-IR quantum cascade lasers, [IEEE J. Quant. Electron. 55, 2300210 \(2019\)](#).
 36. M. Tokman, S. B. Bodrov, Y. A. Sergeev, A. I. Korytin, I. Oladyshkin, Y. Wang, A. Belyanin, and A. N. Stepanov, Second harmonic generation in graphene dressed by a strong terahertz field, [Phys. Rev. B. 99, 155411 \(2019\)](#).

37. F.C.B. Maia, B.T. O'Callahan, A.R. Cadore, I.D. Barcelos, L.C. Campos, K. Watanabe, T. Taniguchi, C. Deneke, A. Belyanin, M.B. Raschke, R.O. Freitas, Anisotropic flow control and gate modulation of hybrid plasmon-phonon polaritons, [Nano Lett. 19, 708 \(2019\)](#).
38. M. Piccardo, M. Tamagnone, B. Schwarz, P. Chevalier, N. Rubin, Y. Wang, C.A. Wang, M.K. Connors, D. McNulty, A. Belyanin, and F. Capasso, Radio frequency transmitter based on a laser frequency comb, PNAS 116, 9181 (2019) www.pnas.org/cgi/doi/10.1073/pnas.1903534116
39. M. Piccardo, P. Chevalier, B. Schwarz, D. Kazakov, Y. Wang, A. Belyanin, and F. Capasso, Frequency-modulated combs obey a variational principle, [Phys. Rev. Lett. 122, 253901 \(2019\)](#).
40. M. Tokman, Z. Long, S. AlMutairi, Y. Wang, V. Vdovin, M. Belkin, and A. Belyanin, Purcell enhancement of the parametric down-conversion in two-dimensional nonlinear materials, *Invited Paper*, [Special Issue of the APL Photonics 4, 034403 \(2019\)](#).
41. J. Jiang, L. Shterengas, T. Hosoda, A. Belyanin, G. Kipshidze, G. Belenky, GaSb-based diode lasers with asymmetric coupled quantum wells, [Appl. Phys. Lett. 113, 071106 \(2018\)](#).
42. M. Piccardo, D. Kazakov, N. A. Rubin, P. Chevalier, Y. Wang, K. Lascola, A. Belyanin, F. Capasso, Time-dependent population inversion grating in a laser frequency comb for microwave and terahertz generation, [Optica 5, 475 \(2018\)](#).
43. T. Feng, L. Shterengas, T. Hosoda, A. Belyanin, G. Kipshidze, Passive mode-locking of 3.25 μm GaSb-based cascade diode lasers, [ACS Photonics 5, 4978 \(2018\)](#).
44. A. Ryan Kutayiah, M. Tokman, Y. Wang, and A. Belyanin, Difference frequency generation of surface plasmon-polaritons in Landau quantized graphene, [Phys. Rev. B. 98, 115410 \(2018\)](#).
45. M. Piccardo, P. Chevalier, S. Anand, Y. Wang, D. Kazakov, E. A. Mejia, F. Xie, K. Lascola, A. Belyanin, and F. Capasso, Widely tunable harmonic frequency comb in a quantum cascade laser, [Appl. Phys. Lett. 113, 031104 \(2018\)](#).
46. M. Piccardo, P. Chevalier, T. S. Mansuripur, D. Kazakov, Y. Wang, N. A. Rubin, L. Meadowcroft, A. Belyanin, and F. Capasso, The harmonic state of quantum cascade lasers: origin, control, and prospective applications (*invited review*), [Optics Express 26, 9464 \(2018\)](#). *Editor's Pick*.
47. P. Chevalier, M. Piccardo, S. Anand, E. A. Mejia, Y. Wang, T. S. Mansuripur, K. Lascola, A. Belyanin, and F. Capasso, Watt-level widely tunable single-mode emission by injection-locking of a multimode Fabry-Perot quantum cascade laser, [Appl. Phys. Lett. 112, 061109 \(2018\)](#).
48. M. Tokman, Z. Long, S. AlMutairi, Y. Wang, M. Belkin, and A. Belyanin, Enhancement of the spontaneous emission in subwavelength quasi-two-dimensional waveguides and resonators, [Phys. Rev. A 97, 043801 \(2018\)](#).

49. V. Kravtsov, S. AlMutairi, R. Ulbricht, A. Ryan Kutayiah, A. Belyanin, M. B. Raschke, Enhanced third-order optical nonlinearity driven by surface-plasmon field gradients, [Phys. Rev. Lett. 120, 203903 \(2018\)](#).
50. Z. Long, Y. Wang, M. Erukhimova, M. Tokman, A. Belyanin, Magneto-polaritons in Weyl semimetals in a strong magnetic field, [Phys. Rev. Lett. 120, 037403 \(2018\)](#).
51. D. Kazakov, M. Piccardo, Y. Wang, P. Chevalier, T. S. Mansuripur, Chung-En Zah, K. Lascola, A. Belyanin, F. Capasso, Self-starting harmonic frequency comb generation in a quantum cascade laser, [Nature Photonics 11, 789 \(2017\)](#).
52. J. König-Otto, Y. Wang, A. Belyanin, C. Berger, W. de Heer, M. Orlita, A. Pashkin, H. Schneider, M. Helm, S. Winnerl, Four-Wave Mixing in Landau-Quantized Graphene, [Nano Lett. 17, 2184-2188 \(2017\)](#).
53. Y. Wang, M. Tokman, and A. Belyanin, Second-order nonlinear optical response of graphene, [Phys. Rev. B 94, 195442 \(2016\)](#).
54. T. S. Mansuripur, C. Vernet, P. Chevalier, G. Aoust, B. Schwarz, F. Xie, C. Caneau, K. Lascola, Chung-en Zah, D. P. Caffey, T. Day, L. J. Missagia, M. K. Connors, C. Wang, A. Belyanin, and F. Capasso, Single-mode instability in standing-wave lasers: quantum cascade laser as a self-pumped parametric oscillator (*Editor's Suggestion*), [Phys. Rev. A, 94, 063807 \(2016\)](#).
55. Q. Zhang, Y. Wang, W. Gao, J. D. Watson, M. J. Manfra, A. Belyanin, and J. Kono Stability of high-density two-dimensional excitons against a Mott transition in high magnetic fields probed by coherent terahertz spectroscopy, [Phys. Rev. Lett. 117, 207402 \(2016\)](#).
56. K. Cong, Q. Zhang, Y. Wang, G. T. Noe II, A. Belyanin, and J. Kono, Dicke superradiance in solids (*invited review*) [JOSA B 33, C80 \(2016\)](#).
57. M. Tokman, Y. Wang, I. Oladyshkin, A. Ryan Kutayiah, and A. Belyanin, Laser-driven parametric instability and generation of entangled photon-plasmon states in graphene, [Phys. Rev B. 93, 235422 \(2016\)](#).
58. D. G. Revin, M. Hemingway, Y. Wang, J.W. Cockburn, A. Belyanin, Active mode locking of quantum cascade lasers operating in external ring cavity, [Nature Comm. 7, 11440 \(2016\)](#).
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