Scott A. Diddams – Curriculum Vitae

Current Position

Fellow, National Institute of Standards & Technology, Boulder, Colorado
Visiting Professor of ECEE & Adjoint Professor of Physics, University of Colorado, Boulder
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Education & Training

JILA, University of Colorado, Postdoc 1996-2000, Optical Physics (T. Clement and J.L. Hall, advisors)
University of New Mexico, Department of Physics & Astronomy, Albuquerque, NM, 1996. Ph.D., Optical Science (J.-C. Diels, advisor)
Bethel College, St. Paul, MN, 1989. B.A., Physics (Summa Cum Laude).

Appointments

2021-present: Visiting Professor, Electrical, Computer, and Energy Engineering, Univ. of Colorado
2014-present: Fellow, National Institute of Standards and Technology
2013-present: Professor Adjoint, Dept. of Physics, Univ. of Colorado
2012-2013: Moore Distinguished Scholar, Caltech
2008-2013: Lecturer, Dept. of Physics, Univ. of Colorado
2007: Visiting Scientist, Max Planck Institute for Quantum Optics (group of Theodor W. Hänsch)
2000-2014: Physicist, National Institute of Standards and Technology
1998-2000: National Research Council Postdoctoral Fellow, National Institute of Standards and Technology, Quantum Physics Division, JILA, University of Colorado (John L. Hall, advisor)
1996-1998: Postdoctoral Research Associate, JILA, University of Colorado (Tracy Clement, advisor)
1990-1996: Teaching and Research Assistant, Univ. of New Mexico, Dept. of Physics and Astronomy
1988-1989: Technical aide, Fiber Optics Lab, 3-M Corporation, St. Paul, MN
1986-1989: Research & Teaching Assistant, Bethel College, St. Paul, MN

Awards & Honors

Presidential Rank Award (2021)
Edward Uhler Condon Award for distinguished written exposition in science or technology (2021)
IEEE Photonics Society Laser Instrumentation Award (2021)
Department of Commerce Bronze Medal for Scientific/Engineering Achievement (2021)
NASA Group Achievement Award for the NEID radial velocity spectrograph (2020)
OSA Paul F. Forman Team Engineering Excellence Award (2020)
IEEE I. I. Rabi Award (2017)
Fellow of NIST (2014)
Jacob Rabinow Award for Innovation (2014)
IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control: Outstanding paper of the year (2013)
Moore Distinguished Scholar in Engineering and Applied Science, Caltech (2012-13)
Department of Commerce Silver Medal Award for Scientific/Engineering Achievement (2011)
Arthur S. Flemming Award (2010)
Finalist, Berthold Leibinger Innovationspreis (2010)
Fellow of Optical Society of America (2009)
Fellow of American Physical Society (2009)
Lecturer at Wilhelm and Else Heraeus Summer School, Wittenberg, Germany (2007)
European Frequency and Time Forum Young Scientist Award (2007)
Presidential Early Career Award for Scientists and Engineers (2003)
Department of Commerce Gold Medal Award for Scientific/Engineering Achievement (2001)

National Research Council Postdoctoral Fellow (1998-2000)
JILA Scientific Award (2000)
Univ. of New Mexico Dept. of Physics and Astronomy Durward D. Young, Jr. dissertation award (1996)
Univ. of New Mexico Center for Advanced Studies Graduate Fellowship (1994-95)

Research Activities

Precision measurements with optical frequency combs, optical clocks, astronomical spectroscopy, laser physics, ultrafast and nonlinear optics, nonlinear nano-photonics, microwave photonics, precision spectroscopy from the UV to THz.

Major Research Accomplishments:

- Invented and developed the first carrier-envelope stabilized femtosecond laser system. This technology has revolutionized the measurement of optical frequencies, is key to the development of optical clocks, and was part of the 2005 Nobel Prize in Physics. Frequency-stabilized mode-locked lasers have also been crucial for the generation of isolated attosecond laser pulses. The first paper on the topic was denoted a "Milestone Letter" at the 50th anniversary of Physical Review Letters. It and a companion paper in Science and have been cited more than a combined 4400 times.
- Built the femtosecond laser frequency comb technology and demonstrated the first optical clock based on a single Hg^+ ion. The techniques described in Science and PRL have been cited over 1300 times and have been adopted by all laboratories pursuing research into advanced optical clocks.
- Demonstrated optical and microwave frequency synthesis at the $1x10^{-19}$ level with femtosecond laser frequency combs. Following four years of work, the key paper was published in Science. It proved that the frequency comb was a perfect optical synthesizer and would not be a limitation in future optical clocks or spectroscopy. This paper has been cited over 400 times.
- Developed and employed novel femtosecond lasers with sub-Hz linewidths to make measurements of absolute atomic frequencies and frequency ratios with 18+ digits of precision. These are now the most precise measurements of any physical quantities. This infrastructure is critical to the comparison of atomic standards for tests of the constancy of fundamental constants and local position invariance. Among many papers co-authored in this area, two of the key ones were published in PRL and Science and have more than 1900 combined citations.
- Established a new approach to broadband spectroscopy in which the femtosecond laser frequency comb is itself used as a probe for precision spectroscopy. Introduced a novel 2-dimensional diagnostic for rapid spectral fingerprinting, and extended such techniques into the mid-infrared spectral region. The original paper in Nature has been cited over 700 times. Simple and robust broad bandwidth infrared frequency combs in the lab now rival the brightness and bandwidth of an infrared synchrotron beamline. These tools are being applied to infrared molecular spectroscopy and hyperspectral imaging.
- Introduced and developed optically-stabilized frequency combs to generate ultra-low noise microwave signals—possessing phase noise and timing jitter significantly lower than what is achievable with the best conventional electronic sources. Here, a key discovery was the limitations introduced by high-speed photodetection, as well as ways to circumvent and understand the quantum limitations. Key publications in Nature Photonics, Optics Letters and IEEE Photonics Journal have combined citations exceeding 840.
- Introduced gigahertz repetition-rate laser combs that are now critical to the most precise astronomical spectroscopy. Technology platforms include 10 GHz solid state lasers, in addition to electro-optic combs and microresonator combs. This technology was employed at the Hobby-Eberly telescope where it yielded the first comb-calibrated stellar spectra, and it has also been evaluated at the IRTF and Keck telescopes on Mauna Kea. Since 2018, a 30 GHz electro-optic frequency comb runs continuously at the McDonald Observatory and is actively used for high-precision radial velocity exoplanet searches.
- Initiated a research program on the development of micro-resonator frequency combs which enable frequency combs to be fabricated on a silicon chip. This work resulted in the first self-referenced microcomb and the application of these chip-scale devices to optical frequency synthesis, a microcomb optical clock, and chip-scale optical clocks. An early review paper in Science motivated development

in the field and has received over 1600 citations. This work is part of the NIST on a Chip Program and has led to significant external research efforts through NASA, AFOSR and DARPA.

Professional Affiliations & Service

Fellow of American Physical Society, Fellow of Optical Society of America, and senior member of IEEE
Associate Editor, *Optica*, Optical Society of America (2015-2021)
Reviewer for NSF, NIST, AFOSR, ERC, Nature, Nature Communications, Nature Photonics, Nature Physics, Nature Scientific Reports, Science, Science Advances, Physical Review Letters, Physical Review A, Physical Review Applied, Applied Physics Letters, Optica, Optics Letters, Optics Express, Applied Optics, JOSA B, IEEE Journal of Lightwave Technology, IEEE Journal of Selected Topics in Quantum Electronics, European Journal of Physics D, Journal of Optics B, IEEE Journal of Quantum Electronics, Photonics Technology Letters, Optics Communications, Applied Physics B.
Guest editor of IEEE Journal of Selected Topics in Quantum Electronics (August 2003)
Program committee for Conference on Precision Electromagnetic Measurement (2002, 2004, 2006)
Co-organizer of John Hall Symposium (2004)
Program committee for IEEE/LEOS Summer Topicals (2005)
Program committee for ESA International Workshop on Optical Clocks (2005)
Program committee for IEEE Frequency Control Symposium (2006-2012)
Program chair for IEEE/LEOS Summer Topical—OFTMAG (2007)
Program topical chair "Frequency Combs and their Applications" CLEO-Europe/IQEC (2007)
Guest editor European J. Phys. D (2007)
Program committee for IEEE Microwave Photonics (2015)
Co-chair of Caltech Keck Institute for Space Studies (KISS) Workshop on Optical Frequency Combs for Space Applications (2015-16)
Program committee for OSA Mid-infrared Coherent Sources (2016)
Program committee for "Precision Metrology and Frequency Combs" CLEO-Europe/EQEC (2017)
Program committee for "Nonlinear Optics and Novel Phenomena" CLEO (2018-2019)
International Steering Committee for the 9th Symposium on Frequency Standards and Metrology (2021)
Conference Organizing Committee for International Conference on Laser Spectroscopy, ICOLS (2021)

Publications and Presentations

290 Peer-reviewed papers, books and proceedings, including papers in *Science* (16), *Phys. Rev. Lett.* (21), *Phys Rev. X* (2), *Nature* (4), *Nature Photonics* (10), *Nature Communications* (4), and *Optica* (13).
166 Invited talks and colloquia
12 Patents granted or submitted
269 Contributed conference papers
Web of Science: >19,900 citations, h-index of 71
Google Scholar: >32,000 citations, h-index of 89

Journal Articles, Books, and Proceedings

290. C. Fredrick, F. Olsen, R. Terrien, S. Mahadevan, F. Quinlan, and S. A. Diddams, "Thermal-light heterodyne spectroscopy with frequency comb calibration," *arXiv* (2021).

289. S. Xing, D.M.B. Lesko, T. Umeki, A. J. Lind, N. Hoghooghi, T.-H. Wu, S. A. Diddams, "Single-cycle all-fiber frequency comb," *APL Photon*. **6**, 086110 (2021). https://doi.org/10.1063/5.0055534

288. D. Lee, T. Nakamura, J. Zang, J. C. Campbell, S. A. Diddams, and F. Quinlan, "Reduction of Flicker Phase Noise in High-Speed Photodetectors under Ultrashort Pulse Illumination," submitted to *IEEE Photonics Journal* **13**, 5500213 (2021). https://doi.org/10.1109/JPHOT.2021.3075381

287. Z. L. Newman, V. Maurice, T. Fortier, C. Frederick, S. A. Diddams, J. Kitching, and M. T. Hummon, "High-performance, compact optical standard," *Opt. Lett.* **46**, 4702 (2021). https://doi.org/10.1364/OL.435603

286. J. Rutledge, A. Catanese, D.D. Hickstein, S.A. Diddams, T. Allison, A. Kowligy, "Broadband ultraviolet-visible frequency combs from cascaded high-harmonic generation in quasi-phase-matched waveguide," JOSA B **38**, 2252-2260 (2021). https://doi.org/10.1364/JOSAB.427086

285. R. C. Terrien , J. P. Ninan, S. A. Diddams, S. Mahadevan, S. Halverson, C. Bender, C. Fredrick, F. Hearty J. Jennings, A. J. Metcalf, A. Monson, A. Roy, C. Schwab, G. Stefánsson, "Broadband stability of the Habitable Zone Planet Finder Fabry-Pérot etalon calibration system:evidence for chromatic variation," to appear in *Astronomical Journal* **161**, 252 (2020). https://doi.org/10.3847/1538-3881/abef68

284. G. Stefánsson, R. Kopparapu, A. Lin, S. Mahadevan, C. I. Cañas, S. Kanodia, J. P. Ninan, W. D. Cochran, M. Endl, L. Hebb, J. Wisniewski, A. Gupta, M. Everett, C. F. Bender, S. A. Diddams, E. B. Ford, C. Fredrick, S. Halverson, F. Hearty, E. Levi, M. Maney, A. J. Metcalf, A. Monson, L. W. Ramsey, P. Robertson, A. Roy, C. Schwab, R. C. Terrien, and J. T. Wright, "A Mini-Neptune and a Venus-Zone Planet in the Radius Valley Orbiting the Nearby M2-dwarf TOI-1266: Validation with the Habitable-zone Planet Finder," *Astronomical Journal*, **160**, 259 (2020) https://doi.org/10.3847/1538-3881/abbe19

283. S. Kanodia, C. I. Cañas, G. Stefansson, J. P. Ninan, L. Hebb, A. S. J. Lin, H. Baran, M. Maney, R. C. Terrien, S. Mahadevan, W. D. Cochran, M. Endl, J. Dong, C. F. Bender, S. A. Diddams, E. B. Ford, C. Fredrick, S. Halverson, F. Hearty, A. J. Metcalf, A. Monson, L. W. Ramsey, P. Robertson, A. Roy, C. Schwab, and J. T. Wright, "TOI-1728b: The Habitable-zone Planet Finder confirms a warm super Neptune orbiting an M dwarf host," *Astrophysical Journal*, 899:29 (2020) https://doi.org/10.3847/1538-4357/aba0a2

282. G. Stefansson, S. Mahadevan, M. Maney, J. P. Ninan, P. Robertson, J. Rajagopal, F. Haase, L. Allen, E. B. Ford, J. Winn, A. Wolfgang, R. I. Dawson, J. Wisniewski, C. F. Bender, C. Canas, W. Cochran, S. A. Diddams, C. Fredrick, S. Halverson, F. Hearty, L. Hebb, S. Kanodia, E. Levi, A. J. Metcalf, A. Monson, L. Ramsey, A. Roy, C. Schwab, R. Terrien, and J. T. Wright, "The Habitable-zone Planet Finder reveals a High Mass and a Low Obliquity for the Young Neptune K2-25B," *Astronomical Journal*, 160:192 (28pp), (2020) https://doi.org/10.3847/1538-3881/abb13a

281. S. Kanodia, C. Cañas, G. Stefansson, J. Ninan, L. Hebb, A. SJ Lin, H. Baran, M. Maney, R C Terrien, S. Mahadevan, W. D Cochran, M. Endl, J. Dong, C F Bender, S.A. Diddams, E. B Ford, C. Fredrick, S. Halverson, F. Hearty, A. J. Metcalf, A. Monson, L. W Ramsey, P. Robertson, A. Roy, C. Schwab, J. T. Wright, "TOI-1728b: The Habitable-zone Planet Finder Confirms a Warm Super-Neptune Orbiting an M-dwarf Host," *Astrophysical Journal* **899**, 29 (2020) https://doi.org/10.3847/1538-4357/aba0a2

280. C. Cañas, G Stefansson, S Kanodia, S Mahadevan, W. D. Cochran, M. Endl, P. Robertson, C. F. Bender, J. P. Ninan, C. Beard, J. Lubin, A. F. Gupta, M. E. Everett, A. Monson, R. F. Wilson, H. M. Lewis, M. Brewer, S. R. Majewski, L. Hebb, R. I Dawson, S. A Diddams, E. B. Ford, C. Fredrick, S. Halverson, F. Hearty, A. Lin, A. J Metcalf, J. Rajagopal, L. W Ramsey, A. Roy, C. Schwab, R. C. Terrien, J. T. Wright, "A Warm Jupiter Transiting an M Dwarf: A TESS Single-transit Event Confirmed with the Habitable-zone Planet Finder," *Astronomical Journal* **160**, 147 (2020) https://doi.org/10.3847/1538-3881/abac67

279. F. Lecocq, F. Quinlan, K. Cicak, J. Aumentado, S. A. Diddams, J. D. Teufel, "Control and readout of a superconducting qubit using a photonic link," *Nature* **591**, 575-579 (2021). https://doi.org/10.1038/s41586-021-03268-x

278. M. I. Bodine, J.-D.Deschênes, I. H. Khader, W. C. Swann, H. Leopardi, K. Beloy, T. Bothwell, S.M. Brewer, S. L. Bromley, J.-S. Chen, S. A. Diddams, R.J. Fasano, T. M. Fortier, Y. S. Hassan, D. B. Hume, D. Kedar, C. J. Kennedy, A. Koepke, D. R. Leibrandt, A. D. Ludlow, W. F. McGrew, W. R. Milner, D. Nicolodi, E. Oelker, T. E. Parker, J. M. Robinson, S. Romish, S. A. Schäffer, J. A. Sherman, L. Sonderhouse, J. Yao, J. Ye, Xi. Zhang, N. R. Newbury and L. C. Sinclair, "Optical Atomic Clock Comparison through Turbulent Air," *Phys. Rev. Research* **2**, 033395 (2020). https://doi.org/10.1103/PhysRevResearch.2.033395

277. H. Leopardi, K. Beloy, T. Bothwell, S. M. Brewer, S. L. Bromley, J.-S. Chen, S. A. Diddams, R. J. Fasano, Y. S. Hassan, D. B. Hume, D. Kedar, C. J. Kennedy, I. Khader, D. R. Leibrandt, A. D. Ludlow, W. F. McGrew, W. R. Milner, D. Nicolodi, E. Oelker, T. E. Parker, J. M. Robinson, S. Romisch, J. A. Sherman, L. Sonderhouse, W. C. Swann, J. Yao, J. Ye, X. Zhang, and T. M. Fortier, "Measurement of the $^{27}Al^{+}$ and ^{87}Sr absolute optical frequencies," *Metrologia* **58**, 015017 (2020). https://doi.org/10.1088/1681-7575/abd040

276. K. Beloy, M. I. Bodine, T. Bothwell, S. M. Brewer, S. L. Bromley, J.-S. Chen, J.-D. Deschenes, S. A. Diddams, R. J. Fasano, T. M. Fortier, Y. S. Hassan, D. B. Hume, D. Kedar, C. J. Kennedy, I. Khader, A. Koepke, D. R. Leibrandt, H. Leopardi, A. D. Ludlow, W. F. McGrew, W. R. Milner, N. R. Newbury, D. Nicolodi, E. Oelker, T. E. Parker, J. M. Robinson, S. Romisch, S. A. Schaffer, J. A. Sherman, L. C. Sinclair, L. Sonderhouse, W. C. Swann, J. Yao, J. Ye, and X. Zhang, "Frequency Ratio Measurements with 18-digit Accuracy Using a Network of Optical Clocks," *Nature* **591**, 564 (2021). https://doi.org/10.1038/s41586-021-03253-4

275. D. M. Lesko, A. J. Lind, N. Hoghoogi, A. S. Kowligy, H. R. Timmers, P. Sekhar, B. Rudin, F. Emaury, G. B. Rieker, and S. A. Diddams, "Fully phase-stabilized 1 GHz turnkey frequency comb at 1.5 um," *OSA Continuum* **3**, 2070 (2020) https://doi.org/10.1364/OSAC.396597

274. D. M. Lesko, H. R. Timmers, S. Xing, A. S. Kowligy, A. J. Lind, and S. A. Diddams, "A 6-octave optical frequency comb from a scalable few-cycle Erbium fiber laser," *Nature Photonics* (2021). https://doi.org/10.1038/s41566-021-00778-y

273. P. Robertson, G. Stefansson, S. Mahadevan, M. Endl, W. D. Cochran, T. Anderson, C. Beard, C. F. Bender, S. A. Diddams, N. Duong, E. B. Ford, C. Frederick, S. Halverson, F. Hearty, R. Holcomb, L. Juan, S. Kanodia, E. Levi, J. Lubin, A. J. Metcalf, A. Monson, J. P. Ninan, J. Palafoutas, L. W. Ramsey, A. Roy, C. Schwab, R. C. Terrien, and J. T. Wright, "Persistent starspot signals on M dwarfs: multi-wavelength Doppler observations with the Habitable-zone Planet Finder and Keck/HIRES," *Astrophysical Journal* **897**, 125 (2020). https://doi.org/10.3847/1538-4357/ab989f

272. S. Xing, A. S. Kowligy, D. M. B. Lesko, A. J. Lind, and S. A. Diddams, "All-fiber frequency comb at 2 μm providing 1.4-cycle pulses," *Opt. Lett*. **45**, 2660-2663 (2020). https://doi.org/10.1364/OL.391486

271. J. P. Ninan, G. Stefansson, S. Mahadevan, C. Bender, P. Robertson, L. Ramsey, R. Terrien, J. Wright, S. A. Diddams, S. Kanodia, W. Cochran, M. Endl, E. B. Ford, C. Fredrick, S. Halverson, F. Hearty, J. Jennings, K. Kaplan, E. Lubar, A. J. Metcalf, A. Monson, C. Nitroy, A. Roy, and C. Schwab, "Evidence for He I 10830 A Absorption during the Transit of a warm Neptune around the M-Dwarf GJ 3470 with the Habitable-Zone Planet Finder," *Astrophysical Journal* **894**, 97 (2020). https://doi.org/10.3847/1538-4357/ab8559

270. S. Diddams, K. Vahala, and T. Udem, "Optical Frequency Combs: Coherently Uniting the Electromagnetic Spectrum," *Science* **369**, eaay3676 (2020). https://science.sciencemag.org/content/369/6501/eaay3676

269. T. Nakamura, J. Davila-Rodriguez, H. Leopardi, J. A. Sherman, T. M. Fortier, X. Xie, J. C. Campbell, W. F. McGrew, X. Zhang, Y. S. Hassan, D. Nicolodi, K. Beloy, A. D. Ludlow, S. A. Diddams, and F. Quinlan, "Coherent Optical Clock Down-Conversion for Microwave Frequencies with 10^{-18} Instability," *Science* **368**, 889-892 (2020). https://doi.org/10.1126/science.abb2473

268. J. Jennings, R. Terrian, C. Fredrick, M. Grisham, M. Notcutt, S. Halverson, S. Mahadevan, and S. A. Diddams, "Frequency stability of the mode spectrum of broad bandwidth Fabry-Pérot interferometers," *OSA Continuum* **3**, 1177-1193 (2020). https://doi.org/10.1364/OSAC.393551

267. C. W. Chou, A. L. Collopy, C. Kurz, Y. Lin, M. E. Harding, P. N. Plessow, T. M. Fortier, S. A. Diddams, D. G. Leibfried, and D. R. Leibrandt, "Precision frequency-comb terahertz spectroscopy on pure quantum states of a single molecular ion, *Science* **367**, 1458 (2020). https://doi.org/10.1126/science.aba3628

266. A. S. Kowligy, D. R. Carlson, D. D. Hickstein, H. R. Timmers, A. J. Lind, S. B. Papp, and S. A. Diddams, "Mid-infrared frequency combs at 10 GHz," *Opt. Lett.* **45**, 3677-3680 (2020) https://doi.org/10.1364/OL.391651

265. A. Lind, A. Kowligy, H. Timmers, F. C. Cruz, N. Nader, M. C. Silfies, T. K. Allison, and S. A. Diddams, "Mid-Infrared Frequency Comb Generation and Spectroscopy with Few-Cycle Pulses and $\chi^{(2)}$ Nonlinear Optics," *Phys. Rev. Lett.* **124**, 133904 (2020). https://doi.org/10.1103/PhysRevLett.124.133904

264. L. Stern, J. R. Stone, S. Kang, D. C. Cole, Z. Newman, K. Vahala, J. Kitching, S. A. Diddams, and S. B. Papp, "Direct Kerr-frequency-comb atomic spectroscopy," *Science Advances* **6**, eaax6230 (2020). https://doi.org/10.1126/sciadv.aax6230

263. G. Stefansson, C. Canas, J. Wisniewski, P. Robertson, L. Hebb, H. Joseph, J. M. Jennings, K. Kaplan, E. Levi, and S. A. Diddams, "A sub-Neptune Sized Planet Transiting the M2.5-Dwarf G 9-40: Validation with the Habitable-Zone Planet Finder," *Astronomical Journal* **159**, 100 (2020) https://doi.org/10.3847/1538-3881/ab5f15

262. A. S. Kowligy, H. Timmers, A. J. Lind, U. Elu, F. C. Cruz, P. G. Schunemann, J. Biegert, and S. A. Diddams, "Infrared electric-field sampled frequency comb spectroscopy," *Science Advances* **5**, eaaw8794 (2019). https://doi.org/10.1126/sciadv.aaw8794

261. Joe P. Ninan; Suvrath Mahadevan; Gudmundur Stefansson; Chad Bender; Arpita Roy; Kyle F. Kaplan; Connor Fredrick; Andrew J. Metcalf; Andrew Monson; Ryan Terrien; Lawrence W. Ramsey; Scott A. Diddams, "Impact of crosshatch patterns in H2RGs on high-precision radial velocity measurements: exploration of measurement and mitigation paths with the Habitable-Zone Planet Finder," *J. of Astronomical Telescopes, Instruments, and Systems*, 5(4), 041511 (2019). https://doi.org/10.1117/1.JATIS.5.4.041511

260. J. K. Shaw, C. Fredrick, and S. A. Diddams, "Versatile digital approach to laser frequency comb stabilization," *OSA Continuum* **2**, 3262-3271 (2019). https://doi.org/10.1364/OSAC.2.003262

259. Jian Yao, Jeff A. Sherman, Tara Fortier, Holly Leopardi, Thomas Parker, William McGrew, Xiaogang Zhang, Daniele Nicolodi, Robert Fasano, Stefan Schäffer, Kyle Beloy, Joshua Savory, Stefania Romisch, Chris Oates, Scott Diddams, Andrew Ludlow, and Judah Levine, "Optical-Clock-Based Time Scale," *Phys. Rev. Applied* **12**, 044069 (2019). https://doi.org/10.1103/PhysRevApplied.12.044069

258. W. Zhang, F. Baynes, S. A. Diddams, and S. B. Papp, "Microrod Optical Frequency Reference in the Ambient Environment," *Phys. Rev. Applied* **12**, 024010 (2019). https://doi.org/10.1103/PhysRevApplied.12.024010

257. Nima Nader, Abijith Kowligy, Jeff Chiles, Eric J. Stanton, Henry Timmers, Alexander J. Lind, Flavio C. Cruz, Daniel M. B. Lesko, Kimberly A. Briggman, Sae Woo Nam, Scott A. Diddams, and Richard P. Mirin, "Infrared frequency comb generation and spectroscopy with suspended silicon nanophotonic waveguides," *Optica* **6**, 1269-1276 (2019). https://doi.org/10.1364/OPTICA.6.001269

256. Tara E. Drake, Travis C. Briles, Jordan R. Stone, Daryl T. Spencer, David R. Carlson, Daniel D. Hickstein, Qing Li, Daron Westly, Kartik Srinivasan, Scott A. Diddams, and Scott B. Papp, "Terahertz-Rate Kerr-Microresonator Optical Clockwork," *Phys. Rev. X* **9**, 031023 (2019). https://doi.org/10.1103/PhysRevX.9.031023

255. Daniel D. Hickstein, David R. Carlson, Haridas Mundoor, Jacob B. Khurgin, Kartik Srinivasan, Daron Westly, Abijith Kowligy, Ivan I. Smalyukh, Scott A. Diddams & Scott B. Papp, "Self-organized nonlinear gratings for ultrafast nanophotonics," *Nature Photonics* **13**, 494–499 (2019). https://doi.org/10.1038/s41566-019-0449-8

254. Jeff Chiles, Nima Nader, Eric J. Stanton, Daniel Herman, Galan Moody, Jiangang Zhu, J. Connor Skehan, Biswarup Guha, Abijith Kowligy, Juliet T. Gopinath, Kartik Srinivasan, Scott A. Diddams, Ian Coddington, Nathan R. Newbury, Jeffrey M. Shainline, Sae Woo Nam, and Richard P. Mirin, "Multifunctional integrated photonics in the mid-infrared with suspended AlGaAs on silicon," *Optica* **6**, 1246-1254 (2019). https://doi.org/10.1364/OPTICA.6.001246

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Patents

F. Quinlan, J. Tuefel, S. Diddams, J. Aumentado, J. Davila-Rodriguez. F. LeCoq, "System for microwave signal delivery to superconducting qubits via a photonic link," provisional patent 2020.

S. Diddams, H. Timmers, A. Kowligy, A. Lind, S. Papp, "Method and apparatus for generating mid-infrared frequency combs," filed 2019.

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S. A. Diddams, P. Del'Haye and S. Papp, "Laser Machining and Mechanical Control of Optical MicroResonators," US Patent # 9,341,781 (2016).

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J. Hall, J. Ye, S. A. Diddams, and L.-S. Ma, United States Patent for "Comb-generating optical cavity that includes an optical amplifier and optical modulator," US Patent #6,201,638.

S. A. Diddams, S. Prein, and J.-C. Diels, "Broadband ultrashort pulse measuring device using non-linear electronics," US Patent #6,025,911.

Invited Presentation, Talks and Colloquia

166. S. Diddams, "Twenty years of optical frequency combs," invited talk at IEEE Photonics Conference, Vancouver (2020).

165. S. Diddams, "Synthesizing Light," colloquium at Texas A&M, College Station (2020).

164. S. Diddams, "20 Years of Optical Frequency Combs: Science, Technology and Applications, tutorial talk at CLEO, San Jose (2020)

163. S. Diddams, "Precision Astronomical Spectroscopy with Laser Frequency Combs," invited talk at APS April Meeting, Washington DC (2020).

162. S. Diddams, "Synthesizing Light," colloquium at Carnegie Mellon University, Pittsburgh (2019).

161. S. Diddams, "Infrared electric-field sampled frequency comb spectroscopy," invited talk at CLEO Europe, Munich (2019).

160. S. Diddams, “Laser Frequency Combs: Optical Frequency Synthesizers for Quantum Metrology,” keynote talk at Workshop on Quantum Technologies, Queretaro, Mexico (2019).

159. S. Diddams, “Infrared Optical Frequency Comb Generation with Nonlinear Ultrafast Photonics,” invited talk at OSA Advanced Photonics, Burlingame (2019).

158. S. Diddams, “Optical Clocks and Synthesizing Light with Microcombs,” invited talk at the OSA Frontiers in Optics meeting, Washington DC (2019).

157. S. Diddams, “Optical Frequency Combs: From Lab Scale to Chip Scale,” invited talk Photonics North, Quebec City (2019).

156. S. Diddams, “Broad bandwidth laser frequency combs for terrestrial and astronomical spectroscopy,” invited talk at the annual meeting of the American Chemical Society, Boston (2018).

155. S. Diddams, “Optical Frequency Combs: From Lab Scale to Chip Scale,” invited talk at ALPS, Yokohama (2018).

154. S. Diddams, “Synthesizing Light,” colloquium at University of Arizona Optical Sciences Center, Tucson (2018).

153. S. Diddams, “The History and Presence of High-resolution Laser Spectroscopy and its Applications,” keynote talk at the SPIE Boulder Damage Symposium, Boulder (2018).

152. S. Diddams, “Infrared laser frequency combs: generation and spectroscopic applications,” invited talk at DAMOP, Ft. Lauderdale (2018).

151. S. Diddams, “Precision Optical Timing: An Opportunity for Integrated Photonics,” invited talke at DARPA ERI Summit, San Francisco (2018).

150. S. Diddams, “Synthesizing Light: New Tools, Wavelengths and Opportunities,” colloquium at Max Planck Institute for Quantum Optics, Garching (2018).

149. S. Diddams, “Infrared Astronomical Spectroscopy and Radial Velocity Measurements with 10 cm/s Precision,” Seminar at NSF Headquarters, Alexandria VA (2018).

148. S. Diddams, “Synthesizing Light,” colloquium at NTT Basic Research Labs, Atsugi (2018).

147. S. Diddams, “Dual-Comb Electric Field Sampled Infrared Spectroscopy,” invited talk at OSA Fourier Transform Spectroscopy, Singapore (2018).

146. S. Diddams, “Kerr-microresonator combs for low-noise frequency synthesis,” invited talk at SPIE Photonics West, San Francisco (2018).

145. S. Diddams, “Infrared laser frequency combs: generation and spectroscopic applications,” seminar at ThorLabs, Newton, NJ (2018).

144. S. Diddams, “Synthesizing Light,” colloquium at University of Electro Communications, Tokyo (2018).

143. S. Diddams, “Synthesizing Light,” colloquium at University of New Mexico (2018).

142. S. Diddams, “Optical Frequency Combs: From Lab Scale to Chip Scale,” colloquium at Boston University (2017).

141. S. Diddams, “Integrated Photonics for Mid-infrared Frequency Comb Generation and Spectroscopy,” presented by Nima Nader in my absence at the IEEE Summer Topicals, San Juan, Puerto Rico (2017).

140. S. Diddams, “Photonic Frequency Synthesis from RF to THz,” presented at the IEEE Photonics Conference, Orlando (2017).

139. S. Diddams, “Optical Frequency Combs for Clocks, Spectroscopy and Astronomy,” invited talk at OSA IONS meeting, Balvanyos (2017).

138. S. Diddams, “Integrated nonlinear optics for spectroscopy and precision frequency metrology,” invited talk at the group retreat of Philip Russel, Max Planck Institute for the Science of Light, Ringberg (2017).

137. S. Diddams, “Optical Frequency Combs: From Lab Scale to Chip Scale” colloquium at the Stonybrook University (2017).

136. S. Diddams, “Advances in optical frequency combs and their applications” colloquium at the Princeton University (2016).

135. S. Diddams, “Advances in optical frequency combs and their applications” colloquium at the Max Planck Institute for the Science of Light, Erlangen (2016).

134. S. Diddams and S. Papp, “Frequency Synthesis with Chip-Scale Microresonators,” presented at OSA Optical Fiber Communications Conference, Anaheim (2016).

133. S. Diddams and S. Papp, “Self-referenced frequency stabilization of a microresonator frequency comb,” presented at the NASA Fundamental Physics Workshop, Dana Point (2016).

132. S. Diddams, “Advances in Optical Frequency Combs and their Applications,” keynote talk presented at Europhoton 2016, Vienna (2016).

131. S. Diddams, “Laser and Parametric Optical Frequency Combs,” presented at the Optical Society of America’s Siegman Summer School on Lasers and Nonlinear Optics, Barcelona (2016).

130. S. Diddams, “Optical Frequency Combs: Nonlinear Optics and the Meeting of the Ultrafast and Ultrastable,” short course presented at the São Paulo School of Advanced Science on Nanophotonics and XV Jorge Andre Swieca School on Nonlinear and Quantum Optics, Campinas Brazil (2016).

129. S. Diddams, “Fundamentals of frequency combs: What they are and how they work,” presented at the Keck Institute for Space Sciences, Pasadena (2015)

128. S. Diddams, S. Papp & K. Vahala, “Precision frequency metrology with parametric microresonator combs,” presented at OSA Integrated Photonics Research, Silicon and Nanophotonics, Boston (2015).

127. S. Diddams, “Optical Frequency Combs for Astronomical Spectrograph Calibration,” presented at workshop on Pathways Towards Habitable Planets, Bern (2015)

126. S. Diddams, “Optical Frequency Combs for Astronomical Spectrograph Calibration,” presented at the Extreme Precision Radial Velocity Workshop, Yale (2015)

125. S. Diddams, S. Papp & K. Vahala, “Precision frequency metrology with microresonator combs,” presented at SPIE Photonics West, San Francisco (2015).

124. S. Diddams, “Optical Frequency Combs: From Lab Scale to Chip Scale,” colloquium at the Laboratoire Kastler Brossel, Paris (2015).

123. S. Diddams, “Optical Frequency Combs: From Lab Scale to Chip Scale,” presented at the 8th Symposium on Frequency Standards and Metrology, Potsdam (2015).

122. S. Diddams, S. Papp & K. Vahala, “Frequency metrology and optical clocks with microresonator combs,” presented at NASA Fundamental Physics Workshop, Pasadena (2014).

121. S. Diddams, “Optical Frequency Combs: Moving from Lab Scale to Chip Scale,” colloquium presented at ICFO, Barcelona (2014).

120. S. Diddams, “The long and short of optical time keeping,” University of Colorado Physics Colloquium, Boulder (2014)

119. S. Diddams, “Photonic generation of ultrastable microwave signals,” presented at Caltech Applied Physics Seminar, Pasadena (2014)

118. S. Diddams, “Photonic generation of ultrastable microwave signals,” presented at PQE Snowbird (2014).

117. S. B. Papp, P. Del’Haye, D. C. Cole, K. Beha, S. A. Diddams, H. Lee, J. Li, K. J. Vahala, “An Optical Microcomb Supporting Fundamental Physics Research on the International Space Station,” presented at NASA ASSGR, Orlando (2013).

116. S. Diddams, “Optical Frequency Combs from A to Z,” presented at OSA Frontiers in Optics (2013).

115. S. Diddams, T. Fortier, S. Papp & F. Quinlan, “Frequency combs for optical clocks and low-noise oscillators,” presented at APS Four-Corners Meeting, Denver (2013).

114. S. Diddams, “Optical Frequency Combs: Moving from Lab Scale to Chip Scale,” presented at UC Santa Barbara (2013).

113. Scott A. Diddams, Florian Adler, Tyler Neely, Kevin Knabe, Daniel Maser & Lora Nugent-Glandorf, “Frequency comb sources and techniques for mid-infrared spectroscopy and sensing,” presented at CLEO, San Jose (2013).

112. S. Diddams, “Optical Frequency Combs: Moving from Lab Scale to Chip Scale,” presented at ICOLS, Berkeley (2013).

111. S. Diddams & Chris Oates, “A guide to building an optical clock,” short course presented at CLEO, San Jose (2014).

110. S. Diddams, “The evolving optical frequency comb,” presented at Univ. of New Mexico Optics Colloquium, Albuquerque (2013).

109. Lora Nugent-Glandorf, Tyler Neely, Florian Adler, Kevin Knabe and Scott A. Diddams, “Mid-infrared Frequency Comb Sources for Rapid and Broadband Trace-Gas Detection,” presented at Ultrafast Optics, Davos (2013).

108. S. Diddams, “Optical frequency comb sources and applications,” presented at Europhoton, Stockholm (2012)

107. T. Fortier, S. Diddams, “Optical frequency combs: looking toward optical frequency measurements at the 10^{-18} level,” presented at SPIE, San Diego (2010).

106. F. Quinlan, T. M. Fortier, M. S. Kirchner, J. A. Taylor, J. C. Bergquist, T. Rosenband, N. Lemke, A. Ludlow, Y. Jiang, C. W. Oates, S. A. Diddams, “Optical frequency combs for low phase noise microwave generation,” presented at URSI GASS, Istanbul (2011).

105. S. Diddams & Chris Oates, “A guide to building an optical clock,” short course presented at CLEO, San Jose (2012).

104. S. A. Diddams, “Synthesis of low jitter optical and microwave waveforms with optical frequency combs,” Worldwide Great Scholars Workshop, Yonsei Univ. Seoul, Korea (2012).

103. S. Papp and S. A. Diddams, “Characterization of picosecond pulse trains from a microresonator optical frequency comb,” SPIE Photonics West, San Francisco (2012).

102. S. A. Diddams, “Development and Application of Optical Frequency Combs,” Laser Applications to Chemical, Security and Environmental Analysis, San Diego (2012).

101 S. A. Diddams, “Generation of micrwaves with ultra-low phase noise using optical frequency combs,” presented at Johns Hopkins Applied Physics Lab, Baltimore (2011).

100. S. A. Diddams, “Combing through earth and space: Broad bandwidth approaches to optical and infrared spectroscopy,” U. of Virginia AMO Colloquium (2011).

99. S. Papp and S. A. Diddams, “Control and characterization of picosecond pulse trains from a microresonator frequency comb,” Nonlinear Optics, Kauai (2011).

98. S. A. Diddams, “Synthesis of low jitter optical and microwave waveforms with optical frequency combs,” Univ. of Colorado Optics Seminar (2011).

97. S. A. Diddams, “Combing through earth and space: Broad bandwidth approaches to optical and infrared spectroscopy,” Symposium on A Revolution in Spectroscopy by the Optical Frequency Comb, Tsukuba, Japan (2011).

96. S. A. Diddams, T. Neely, L. Nugent-Glandorf, F. Adler, K. Knabe, P. Williams, F. Giorgetta, E. Baumann, I. Coddington, A. Zolot and N. Newbury, “Broad Bandwidth Trace Gas and Standoff Detection with Infrared Frequency Comb Sources,” FACSS, Reno (2011).

95. S. A. Diddams, F. Adler, T. Fortier, M. Kirchner, S. Meyer, T. Neely, L. Nugent-Glandorf, S. Papp, F. Quinlan, J.r Taylor, G. Ycas, The evolving optical frequency comb: Expanding applications for a precision optical frequency synthesizer,” IEEE FCS and EFTF Joint meeting, San Francisco (2011).

94. S. A. Diddams, “Science and Technology with Optical Frequency Combs,” CLEO invited tutorial, Baltimore (2011).

93. S. A. Diddams and C. Oates, “A Guide to Building an Optical Clock,” CLEO Short Course, San Jose (2010).

92. S. A. Diddams, “Low jitter optical and microwave waveform synthesis with frequency combs,” Microwave Photonics Arbitrary Waveform Generation Workshop, Montreal (2010).

91. S. A. Diddams, “Use of Lasers in Time and Frequency Applications,” OSA Frontiers in Optics, Rochester (2010).

90. S. A. Diddams, “Optical Combs with Large Mode Spacing: Sources and Applications,” SPIE Photonics West, San Francisco (2010).

89. S. A. Diddams, “Mid-infrared frequency comb spectroscopy: sources and detection techniques,” Stanford Photonics Research Center Annual Symposium, Palo Alto (2010).

88. S. A. Diddams, T. Johnson, and L. Nugent-Glandorf, “Mid-infrared frequency comb up-conversion spectroscopy”, American Chemical Society Annual meeting, Boston (2010).

87. S. A. Diddams, “Coming through earth and space: Broad bandwidth approaches to optical and infrared spectroscopy, JILA Chemical Physics Colloquium, Boulder (2009)

86. S. A. Diddams, “Coming through earth and space: Broad bandwidth approaches to optical and infrared spectroscopy, Optical Sciences Colloquium, Univ. of Arizona, Tucson (2009)

85. S. A. Diddams, “Femtosecond optical frequency combs and their applications in precision time and frequency metrology,” presented at AIST, Tsukuba (2009).

84. S. A. Diddams, “Femtosecond optical frequency combs and their applications in precision time and frequency metrology,” presented at the 4th International Symposium on Ultrafast Photonic Technologies, Sendai (2009).

83. S. A. Diddams, “Optical Frequency Combs: Introduction, Sources and Applications,” tutorial presented at EFTF IEEE FCS Joint Meeting, Besancon (2009).

82. S. Diddams & Chris Oates, “A guide to building an optical clock,” short course presented at CLEO, Baltimore (2009).

81. S. A. Diddams, “Tick tock: counting by femtoseconds with an optical clock,” Workshop on Synchronization in Telecommunication Systems (WSTS '09), Broomfield (2009).

80. W.M. Itano, T. Rosenband, D.B. Hume, P.O. Schmidt, C.W. Chou, A. Brusch, L. Lorini, W.H. Oskay, R.E. Drullinger, S. Bickman, T.M. Fortier, J.E. Stalnaker, S.A. Diddams, W.C. Swann, N.R. Newbury, D.J. Wineland, and J.C. Bergquist, “Ratio of the Al+ and Hg+ Optical Clock Frequencies to 17 Decimal Places,” presented at ISQM, Tokyo (2008).

79. L. Hollberg, Q. Quraishi, D. A. Braje, T. Fortier, M. Kirchner, Shijun Xiao, C. W. Oates and S. A. Diddams, “High stability optical and microwave signals from femtosecond laser optical frequency combs,” presented at LEOS Annual Meeting, Newport Beach (2008).

78. S. A. Diddams, “Femtosecond Laser Frequency Combs: The Gears of Optical Atomic Clocks” presented at CENAM Metrology Symposium, Queretaro, Mexico (2008).

77. L. Hollberg, Z. Barber, D. Braje, S.A. Diddams, T. Fortier, V. Gerginov, M. Kirchner, Y. LeCoq, N. Lemke, V. Mbele, S. Meyer, C.W. Oates, N. Poli, Q. Quraishi, J. Stalnaker, C. Tanner, A. Weiner and S. Xiao ,” Precisely Controlled Lasers for Probing Atoms and Other Applications,” presented at Laser Physics, Trondheim, Norway (2008)

76. D. A. Braje, M. Kirchner, T. Fortier, L. Hollberg & S. Diddams, “Filtering the femtosecond frequency comb to spectrally-resolvable frequency spacing and applications thereof,” presented at Laser Physics, Trondheim, Norway (2008)

75. D. Braje, T. J. Kippenberg , P. Del’Haye , L. Hollberg , and S. A. Diddams,” Optical Frequency Comb Generation in HNLF Cavities,” presented at OSA Frontiers in Optics, Rochester (2008).

74. S. A. Diddams, T. Fortier, D. Braje, D. Heinecke, M. Kirchner, V. Mbele, S. A. Meyer, Q. Quraishi, S. Xiao, and L. Hollberg, “Femtosecond Laser Frequency Combs: A Decade of Diversification,” Seventh Symposium on Frequency Standards and Metrology, Pacific Grove (2008).

73. S. Diddams, D. Braje, T. Fortier, M. Kirchner, V. Mbele, S. Meyer, Q. Quraishi, S. Xiao, and L. Hollberg, “The evolving optical frequency comb,” presented at Ultrafast Phenomena, Lago Magiore (2008).

72. S. Diddams, “Tick-tock: Counting by femtoseconds with an optical clock,” colloquium at Ball Aerospace, Boulder, 2008

71. S. Diddams, Bigger and Better: The Critical Role of Self-Phase Modulation in Ultraprecise Optical Frequency Combs,” presented at CLEO/QELS, Baltimore, 2007.

70. S. Diddams, “Ultrafast and ultrastable,” presented at Carl Zeiss award for Jun Ye, Munich, 2007.

69. J.E. Stalnaker, S.A. Diddams, T.M. Fortier, V. Gerginov, Y. Le Coq, V. Mbele, C.W. Oates, D. Ortega, C.E. Tanner, and L. Hollberg, "High-Resolution Spectroscopy with Femtosecond Optical Combs," presented at CLEO/QELS Baltimore, 2007.

68. L. Hollberg, Z. Barber, C. Hoyt, Y. Le Coq, C. Oates, T. Fortier, J. Stalnaker and S. Diddams, "Optical Clocks for Precision Timing Using Solid State Lasers," OSA Advanced Solid State Photonics, 2007.

67. S. Diddams, "Low-Noise Microwave and Optical Waveform Synthesis with Femtosecond Laser Frequency Combs," LEOS Annual Meeting, Orlando, Oct. 2007.

66. S. Diddams, "From a comb to a brush: Expanding tools and applications in optical frequency metrology," colloquium at Sandia National Lab, Combustion Research Facility, Livermore, Nov. 2007.

65 S. Diddams, "Revolution & Evolution in Optical Frequency Metrology," presented at MPQ group retreat, Ringberg, Germany, Sept. 2007.

64. S. Diddams, "From a Comb to a Brush: Expanding Tools and Applications in Optical Frequency Metrology," colloquium at Univ. of Bonn Institute for Applied Physics, July, 2007.

63. S. Diddams, "Optical clocks, precision spectroscopy and waveform synthesis with frequency combs," Wilhelm and Else Heraeus Summer School on "Optical Supercontinua and Frequency Combs", Wittenberg, Germany, July, 2007.

62. S. Diddams, "Bigger and Better: The Critical Role of Self-Phase Modulation in Ultraprecise Optical Frequency Combs," CLEO/QELS Symposium on the 40th anniversary of self-phase modulation, Baltimore, 2007.

61. S. Diddams, " First a comb, then a brush: Expanding tools and applications in optical frequency metrology," Max-Planck Institute for Quantum Optics, Garching, 2007.

60. S. Diddams, "Untangling challenges in frequency metrology with optical combs," NIST Boulder Colloquium, 2006.

59. S. Diddams, "Optical Frequency Metrology and Beyond: New Directions with Femtosecond Frequency Combs," OSA Frontier in Optics, Rochester, 2006.

58. S. Diddams, "Optical frequency combs for space? Some considerations, projections and possibilities," workshop on Optical Frequency Combs for Space, NPL, Teddington, 2006.

57. S. Diddams, "Femtosecond laser frequency combs and their use in precision optical frequency metrology," colloquium at East China Normal University, Shanghai, April 2007.

56. S. Diddams, "Femtosecond laser frequency combs and their applications in AMO physics," DAMOP, Knoxville, 2006.

55. S. Diddams, "Femtosecond laser frequency combs and their use in precision spectroscopy, low noise frequency synthesis, and optical clocks," colloquium at UC Berkeley, March 2006.

54. S. Diddams, " Tick-tock: Counting the femtoseconds of optical atomic clocks," presented at ISAMOP, Tokyo, January 2006.

53. L. Hollberg, S.A. Diddams, J.J. McFerran, E.N. Ivanov, G. Wilpers and C.W. Oates, "Optical and microwave frequency stability: some constraints," LEOS Summer Topicals—OFTMAG, (2005).

52. S. Diddams, "Applications of nonlinear microstructure fibers," presented at the workshop on Applications of Microstructure Fibers at the Optical Fiber Conference, Anaheim, 2005.

51. S. Diddams, "Atomic Clocks: Past, Present and Future," colloquium at Univ. Konstanz, June 2005.

50. S. Diddams, "Tick-Tock: Making time with an optical clock," colloquium at ETH, Zurich, June, 2005.

49. S. Diddams, A. Bartels, T. Fortier, E. Ivanov, K. Kim, J. McFerran, W. H. Oskay, G. Wilpers, C. W. Oates, J. C. Bergquist and L. Hollberg, V. Gerginov, C. Tanner, "Femtosecond laser frequency combs: optical synthesizers for precision spectroscopy and frequency metrology," EQEC, Munich (2005).

48. S. Diddams, "Tick-Tock: Making time with an optical clock," JILA Optics Seminar, March 2005.

47. S. Diddams, "Femtosecond Laser Frequency Combs: Optical Synthesizers for Precision Spectroscopy and Frequency Metrology," colloquium at School of Mines, Physics Dept. Feb. 2005.

46. S. Diddams,"Optical clocks and frequency synthesis using femtosecond lasers," IEEE-LEOS 17th Annual Meeting, Paper WH-1, Nov. 8-9, 2004.

45. S. A. Diddams, Optical Atomic Clocks: Science and Metrology on the Femtosecond Time Scale," presented at Physics of Seeded FEL's, MIT, Boston, June 17-19, 2004.

44. S.A. Diddams, "Optical clocks and frequency synthesis using femtosecond lasers," 7th International Symposium on Contemporary Photonics Technology, Tokyo, 2004.

43. L. Hollberg, C. Oates, S. Diddams, G. Wilpers, A. Curtis, A. Bartels, C. Hoyt, T. Ramond, "Optical clocks with cold atoms," The 16th Annual Meeting of IEEE/LEOS, 26-30 Oct. 2003, p. 3-4.

42. S. Diddams, "Optical atomic clocks: science and metrology on the femtosecond time scale," Physics Dept. Colloquium, Cornell University, 2003.

41. S. Diddams, "Counting optical cycles: femtosecond lasers applied to optical frequency metrology," Gordon Conference on Nonlinear Optics, 2003.

40. T. Ramond, A. Bartels, S. Diddams, L. Hollberg, "Femtosecond lasers for optical clocks and precision frequency measurements, presented at XI International conference on Laser Optics, St. Petersburg, 2003.

39. S. Bize, S. Diddams, U. Tanaka, C.E. Tanner, W. Oskay, T. Parker, R. Drullinger, H. Heavner, S. Jefferts, L. Hollberg, W. Itano, D. Wineland, J. Bergquist, "The mercury single-ion optical clock and a test of the stability of the fundamental constants," IEEE/LEOS Summer Topical Meeting, Vancouver (2003).

38. S. Diddams, "Optical clocks and low noise frequency synthesis using femtosecond lasers," IEEE/LEOS Summer Topical Meeting, Vancouver (2003).

37. A. Bartels, T.M. Ramond, S.A. Diddams, L. Hollberg, "Synthesis of ultrastable femtosecond pulse trains from an optical reference oscillator," presented at the Conference on Lasers and Electo-optics, 2003.

36. S. A. Diddams, "Femtosecond laser synthesizers: microwave, optical and everything in between," presented at BNM-SYRTE, Paris, 2003.

35. S. A. Diddams, "Femtosecond lasers: the gears of optical atomic clocks," presented at the BIPM workshop of frequency combs, Paris, 2003.

34. S. A. Diddams, "Counting optical cycles with a femtosecond laser," presented at AIST, Tsukuba, Japan, 2003.

33. S. A. Diddams, "Femtosecond lasers: the gears of optical atomic clocks," presentation to the NRC review panel for the NIST Physics Laboratory, Gaithersburg, 2003.

32. S. A. Diddams, "Counting optical cycles with a femtosecond laser," presented at the annual meeting of the American Association for the Advancement of Science, Denver, 2003.

31. N. Newbury, K. Corwin, J. Dudley, S. Diddams, K. Weber, R. Windeler, "Measurements and simulations of noise imposed on supercontinuum generated in microstructure fiber," preseted at IEEE/LEOS 2002 annual meeting, 2002.

30. C. Oates, S. Diddams, S. Bize, E. A. Curtis, T. Ramond, A. Bartels, J. Bergquist, L. Hollberg, "Frequency metrology with optical clocks: comparison of the Ca and Hg^+ clock transitions," preseted at IEEE/LEOS 2002 annual meeting, 2002.

29. S.A. Diddams, "Fast lasers and slow atoms: A union for optical clocks of the future," presented at Harvard/MIT Center for Ultracold Atoms, 2002.

28. S.A. Diddams, T.M. Ramond, C.W. Oates, E.A. Curtis, I. Thomann, S. Bize, J.C. Bergquist, L. Hollberg, A. Bartels, H. Kurz, "Fast lasers and slow atoms: A combination for atomic clocks in the optical domain," presented at the OSA-ILS Annual Meeting, 2002

27. S.A. Diddams, C. W. Oates, E. A. Curtis, W. M. Itano, R. E. Drullinger, D. J. Wineland, J. C. Bergquist, and L. Hollberg, Th. Udem, L.-S. Ma, L. Robertsson, "Femtosecond lasers in precision time and frequency metrology," presented at the Conference on Lasers and Electo-optics, 2002

26. S.A. Diddams, "Optical synthesizers for atomic clocks in the optical domain," briefing at NRC committee of the assessment of PTTI science and technology, NAS Beckman Center, Irvine, 2002.

25. S.A. Diddams, "Fast lasers and slow atoms: A union for optical clocks of the future," Physics Colloquium at University of Arizona, Tucson, 2001.

24. S. A. Diddams, Th. Udem, K. R. Vogel, L.-S. Ma, L. Robertsson, C. W. Oates, E. A. Curtis, W. M. Itano, R. E. Drullinger, D. J. Wineland, J. C. Bergquist, L. Hollberg, "Optical frequency metrology and optical clocks using femtosecond lasers," presented OSA Annual Meeting, 2001.

23. S.A. Diddams, "Fast lasers and slow atoms: A union for optical clocks of the future," Physics Colloquium at University of Colorado, Boulder, 2001.

22. S.A. Diddams, "Atomic Clocks in the Optical Domain," Physics & Astronomy Colloquium at University of New Mexico, Albuquerque, 2001.

21. S.A. Diddams, "Atomic Clocks in the Optical Domain," Physics Colloquium at Colorado School of Mines, Golden, 2001.

20. S.A. Diddams, "Frequency measurements of cold-atom optical clocks," Bulletin of the Am. Phys. Soc., Vol. 46, No. 2, 2001, p. 138.

19. C.W Oates, E.A. Curtis, S.A. Diddams, K.R. Vogel, L. Hollberg, "Optical clock/frequency standard at 657 nm based on laser-cooled neutral calcium atoms," presented at Quantum Electronics and Laser Science Conference, 2001, pp. 181 -182.

18. R. Rafac, W. Itano, K. Vogel, S.A. Diddams, C. Oates, A. Curtis, R. Fox, L. Hollberg, J. Bergquist, "Sub-dekahertz ultraviolet spectroscopy," presented at OSA Annual Meeting, 2000.

17. S. A. Diddams, "Optical frequency measurement and control from Hz to PHz," presented at Workshop on Quantum Optics, Jackson Hole, 2000.

16. S. A. Diddams, D. J. Jones, Jun Ye, S. T. Cundiff and J. L. Hall, "Optical frequency metrology with femtosecond lasers," presented at MPLP, Novosibirsk, Russia, 2000.

15. S. A. Diddams, D. J. Jones, Jun Ye, S. T. Cundiff and J. L. Hall, "Linking microwave and optical frequencies with a femtosecond laser comb," presented at IEEE Frequency Control Symposium, 2000.

14. S. A. Diddams, D. J. Jones, Jun Ye, S. T. Cundiff, J. L. Hall, J. K. Ranka, R. S. Windeler, "A direct rf to optical frequency measurement with a femtosecond laser comb spanning 300 THz," presented at Quantum Electronics and Laser Science Conference, 2000.

13. S. A. Diddams, "Optical frequency metrology with a 300 THz femtosecond laser comb," seminar at Max Planck Institute for Quantum Optics, Garching, Germany, 2000.

12. S. A. Diddams, D. J. Jones, Jun Ye, S. T. Cundiff and J. L. Hall, "Ultrafast lasers for ultrastable optical frequency standards," presented at Physics of Quantum Electronics, Snowbird, 2000.

11. S. A. Diddams, "Ultrafast lasers for ultrastable optical frequency standards," seminar at Univeristy of Texas, Austin, 1999.

10. S. A. Diddams, "Characterizing Femtosecond Pulse Propagation in Nonlinear Media," presented at Sandia National Laboratory, Livermore, 1998.

9. T. S. Clement, S. A. Diddams, H. K. Eaton, and A. A. Zozulya, "Nonlinear propagation of femtosecond pulses in bulk media," paper TuP4 presented at IEEE-LEOS Annual Meeting, Orlando, 1998.

8. S. A. Diddams, "Femtosecond Pulse Propagation in Nonlinear Media," presented at Naval Research Laboratory, Washington, 1997.

7. S. A. Diddams, "Characterizing Femtosecond Pulse Propagation in Nonlinear Media," presented at Sandia National Laboratory, Albuquerque, 1997.

6. S. A. Diddams, B. Atherton and J.-C. Diels, "Diagnostics and applications with femtosecond ring lasers," presented at the International Conference on Lasers '95, Charleston, 1995.

5. J.-C. Diels, S. A. Diddams and B. Atherton, "Coherent interactions inside a ring laser," presented at the Winter Quantum Electronics Conference, Snowbird, 1995.

4. J.-C. Diels, S. A. Diddams, and B. Atherton, "Ultrafast intracavity high-resolution spectroscopy," presented at the Conference on Quantum Coherence and Interference in Fundamental and Applied Physics, Crested Butte, 1994.

3. J.-C. Diels, B. Atherton, and S. A. Diddams, "High sensitivity phase spectroscopy with picosecond resolution," in Proceedings of the Fifth European Quantum Electronics Conference, Amsterdam, Netherlands, 1994, p.195.

2. J.-C. Diels, S. A. Diddams, and B. Atherton, "Sagnac spectroscopy," presented at the Winter Quantum Electronics Conference, Snowbird, 1994.

1. J.-C. Diels, S. A. Diddams, and X. Long, "Sagnac spectroscopy," presented at the Workshop on Atomic Coherence and Interference in Quantum Optics, Crested Butte, 1992.

Contributed Presentations

269. F. Lecocq, J. Aumentado, S. A. Diddams, F. J. Quinlan, and J. D. Teufel, "Control and readout of a superconducting qubit using a cryogenic photonic link," in OSA Quantum 2.0 Conference, M. Raymer, C. Monroe, and R. Holzwarth, eds., OSA Technical Digest (Optical Society of America, 2020), paper QM6A.3.

268. J. Rutledge, A. Catanese, M. Silfies, X. Li, H. Timmers, A. S. Kowligy, A. Lind, S. A. Diddams, and T. K. Allison, "Mid-Infrared Frequency Comb with 6.7 W Average Power Based on Difference Frequency Generation," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2020), paper SF1H.2.

267. C. Fredrick, F. Olsen, R. Terrien, S. Mahadevan, F. Quinlan, and S. Diddams, "Optical Frequency Comb Calibrated Near Infrared Solar Heterodyne Spectroscopy," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2020), paper STu4N.2.

266. N. V. Nardelli, K. Beloy, M. I. Bodine, T. Bothwell, S. Brewer, S. Bromley, J. Chen, E. Clements, J. D. Deschenes, S. A. Diddams, R. Fasano, T. M. Fortier, Y. Hassan, D. H. Hume, D. Kedar, C. J. Kennedy, I. Khader, M. E. Kim, A. Koepke, D. R. Leibrandt, H. Leopardi, A. Ludlow, W. F. McGrew, W. Milner, N. Newbury, D. Nicolodi, E. Oelker, T. Parker, J. M. Robinson, S. A. Schaffer, J. A. Sherman, L. C. Sinclair, L. Sonderhouse, W. C. Swann, D. J. Wineland, J. Yao, J. Ye, and X. Zhang, "10-18 Optical Atomic Clock Comparisons within the Boulder Atomic Clock Network," in Conference on Lasers and Electro-Optics, OSA Technical Digest (Optical Society of America, 2020), paper STh3G.3.

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100 THz with a femtosecond laser frequency comb," postdeadline paper presented at OSA Annual Meeting, 1999.

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11. B. Atherton, S. A. Diddams, and J.-C. Diels, "Ultrasensitive phase measurements with femtosecond ring lasers," presented at NATO Advanced Study Institute 47th SUSSP Summer School, St. Andrews, 1995

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7. S. A. Diddams, "Measurement of ultrashort optical pulses," presented at CHTM Student Seminar Series, Albuquerque, 1994.

6. B. W. Atherton, S. A. Diddams, and J.-C. Diels, "Intracavity ring-laser, femtosecond, phase sensitive spectroscopy," presented at OSA Annual Meeting, Toronto, 1993, paper ThLL5.

5. X. M. Zhao, S. A. Diddams, and J.-C. Diels, "Pure linear method to determine the amplitude and phase of a femtosecond pulse," in Conference on Lasers and Electro-Optics, Vol. 11, 1993 OSA Technical Digest Series (Optical Society of America, Washington, D.C., 1993), pp. 568-571.

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3. S. A. Diddams, J.-C. Diels, and X. Long, "Sagnac spectroscopy," presented at OSA Annual Meeting, Albuquerque, 1992.

2. S. A. Diddams and J.-C. Diels, "Dispersion characterization of optical materials with white light interferometry," presented at OSA Annual Meeting, Albuquerque, 1992.

1. S. A. Diddams, and R.W. Peterson, "Reflection holograms for lecture demonstrations," presented at AAPT Apparatus Competition, Ithaca, 1988, first prize award—college and university category.

Collaborators, Visiting Scientists, PostDocs & Students

Collaborators & Visiting Scientists

Thomas Udem, *Max Planck Institute for Quantum Optics* (2000, 2007, 2019)
T. W. Haensch, *Max Planck Institute for Quantum Optics* (2007)
Jeff Nicholson, Robert Windeler, Paul Westbrook, *OFS Optics* (2000-present)
Alex Zozulya, *JILA and Worcester Polytechnic Institute* (1996-1999)
Carol Tanner, *Univ of Notre Dame* (2003-2008)
John Dudley, *Univ of Franche-Comté* (2002-3)
Justin Torgerson, Fio Omenetto, *Los Alamos National Lab* (2004-2008)
Lennart Robertsson, *BIPM* (2001-2004)
Ma Long-Sheng, *BIPM and East China Normal University* (1998-present)
Bi Zhiyi, *East China Normal University* (2003)
Feng-Lei Hong, *AIST* (2002-04); now at *Yokohama University*
Yohei Kobayashi, *AIST* (2004-present); now at *Tokyo University*.
Albrecht Bartels, *GigaOptics and Univ. Of Konstanz* (2005-present)
Eugene Ivanov, *Univ. of Western Australia* (2001-06)
Andy Weiner, *Purdue Univ*. (2006-07, 2014)
Danielle Braje, *NIST* (2007-08)
Lora Nugent-Glandorf, *NIST-CU* (2009-2014)
Kerry Vahala, *Caltech* (2010-present)
Joe Campbell, *University of Virginia* (2010-present)
Flavio Cruz, *UNICAMP, Brazil* (2008-present)
Suvrath Mahadevan, *Penn State Univ.* (2010-present)
John Bowers, *UC Santa Barbara* (2014-present)
Kartik Srinivasan, *NIST Gaithersburg* (2014-present)
Tobias Kippenberg, *EPFL* (2007, 2014-present)
John Kitching, *NIST* (2015-present)
Hong Tang, *Yale University* (2015-present)
Thomas Schibli, *Univ. of Colorado* (2012-present)
Markus Raschke, *Univ. of Colorado* (2018-present)
Greg Rieker, *Univ. of Colorado* (2019-present)
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Postdocs supervised or co-supervised

Albrecht Bartels, NIST (2001-2004); now at Laser Quantum, Konstanz
Tanya Ramond, NIST-NRC postdoc (2002-04); now at Ball Aerospace, Boulder
Kristan Corwin, NIST-NRC postdoc (2002-04); now at NIST, Boulder
Tara Fortier, Los Alamos National Lab postdoc (2004-08); now at NIST, Boulder

John McFerran, NIST (2004); now at Univ. of Western Australia
Kyoungsik Kim, NIST-CU postdoc (2004-05); now at Yonsei University, Seoul.
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Shijun Xiao, NIST (2007-09); now at CoAdna Photonics
Todd Johnson, NIST-NRC posdoc (2008-10); now at College of St. John's
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Antoine Rolland, NIST (2014-2015) now at IMRA America
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Wei Zhang, NIST-CU (2016-2018); now at JPL
Daniel Hickstein, NIST-NRC (2016-2018); now staff at KM Labs
Tara Drake, NIST-NRC (2015-2019); now professor at UNM, Albuquerque
Travis Briles, NIST-CU (2015-2019); now at NIST
Daryl Spencer, NIST-NRC (2016-2018)
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David Carlson, NIST-NRC (2016-2018); now at Octave Photonics
Abijith Kowligy, NIST-CU (2016-2020); now at Vector Atomic
Henry Timmers, NIST-CU (2017-2019); now at Vescent Photonics
Sida Xing, NIST-CU (2019-present)
Tsung-Han Wu, NIST-CU (2020-present)
Stephanie Swartz, NIST-NRC (2021-present)

PhD Students supervised as primary advisor

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Jennifer Taylor, Ph.D, Univ. of Colorado (2009-2012); now at US Naval Observatory
Gabe Ycas, Ph.D, Univ. of Colorado (2009-2013); now at Honeywell
Daniel Maser, Ph.D, Univ. of Colorado (2012-2017); now professor at Connecticut College
Daniel Cole, Ph.D, Univ. of Colorado (2012-2018); now NRC postdoc at NIST Boulder
Holly Leopardi, Ph.D, Univ. of Colorado (2015-2019); now postdoc at AFRL Albuquerque
Connor Fredrick, Univ. of Colorado (2015-present)
Alexander Lind, Univ. of Colorado (2015-present)
Daniel Lesko, Univ. of Colorado (2019-present)
Pooja Sekhar, Univ. of Colorado (2020-present)
Eugene Tsao, Univ. of Colorado (2020-pesent)
Peter Chang, Univ. of Colorado (2020-present)

Other Graduate Students Supervised/Advised

Isabell Thomann, Univ of Colorado (2001-02)
Karl Weber, Univ. of Melbourne (2002)
Giovanna Nogueria, UNICAMP Brasil (2005)
Michael Thiel, Univ of Karlsruhe (2005)

Ole Mussman, Univ. of Konstanz (2006)
Vela Mbele, CSIR-NML and Univ of Witwatersrand (2005-2008)
Dirk Heinecke, Univ. of Konstanz (2008-2010)
Antoine Rolland, Univ. of Rennes (2012)
Adam Green, Univ. of Colorado (2013-14)
Daniel Hackett, Univ. of Colorado (2014-15)
Francisco Viera Senna, *UNICAMP Brazil* (2015)
Jordan Stone, Univ. of Colorado (2015-18)
William Depetri, *UNICAMP Brazil* (2019)

Undergrad Students

Matt Kirchner, Colorado School of Mines (2005); now at Thorlabs
Kyle Johnson, Colorado School of Mines (2005)
Paul Blanchard, Colorado School of Mines (2005); now at NIST Boulder
Brett Kachel, Colorado School of Mines (2006-07)
Anne Baldwin (2008)
Max Diddams, Carleton College (2010); now MD at University of North Carolina
Jessica Doehrmann, Bethel College (2011); PhD UofA; now at Honeywell
Robert Kealhofer, Harvey Mudd College (2012); now postdoc at UCSB
Isaac Shelby, *Carneige-Mellon* (2014)
Jeff Jennings, *Univ. of Colorado* (2015); now at University Cambridge
Bella Ferranti, *Southwestern University* (2016)
Jordan Deitsch, *Univ. of Colorado* (2017)
Freja Olsen, *Carleton College* (2019)
Kyle Kelly, *Univ. of Colorado* (2020)
Molly Kate Kreider, *Univ. of Richmond* (2021)

High School Students

Abigail Newbury, Fairview High School (2017-2018); now at University of Virginia
Aria Mundy, Fairview High School (2018-2019); now at University of Colorado