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## EDUCATION

- Princeton University – Princeton, NJ** **June 2009**  
*Ph.D. in Electrical Engineering*  
*Thesis: New Quantum Cascade Laser Architectures*  
*available: [http://www.kjfranz.us/files/KJFranz\\_thesis.pdf](http://www.kjfranz.us/files/KJFranz_thesis.pdf)*
- Princeton University – Princeton, NJ** **June 2006**  
*M.A. in Electrical Engineering*
- Colorado School of Mines – Golden, CO** **May 2004**  
*B.S. in Engineering Physics* GPA 4.00/4.00 (1<sup>st</sup> in class)  
*Minor in Electrical Engineering*  
*Minor in Public Affairs*

## PROFESSIONAL & RESEARCH EXPERIENCE

- Princeton University – Princeton, NJ** *Post-doc Research Engineer* **2009**  
*Adviser: Prof. Gerard Wysocki*
  - Developed traditional heterodyne detection systems
  - Researched non-traditional heterodyne techniques for trace gas detection
  - Designed and built opto-electronic systems from off-the-shelf and research-grade components
  - Authored detection and analysis algorithms in MATLAB
- Primis Technologies LLC – Princeton, NJ** *Founding Partner & Senior Engineer* **2006 – 2009**
  - Founded a startup company leveraging graduate research in mid-infrared laser and systems technology
  - Developed core intellectual property, including
    - advanced quantum cascade laser design software
    - novel quantum cascade laser designs and strategies
    - mid-infrared spectroscopic sensing systems
  - Author of funding proposals for spectroscopic sensor systems and laser development
- Princeton University – Princeton, NJ** *Assistant in Research* **2004 – 2009**  
*Adviser: Prof. Claire Gmachl*
  - Researched infrared quantum cascade semiconductor lasers for applications in medical diagnostics, explosives sensors, and infrared countermeasures
  - Explored novel strategies for enhancing quantum cascade laser design performance
  - Investigated laser device structures for infrared wavelengths ranging from 3  $\mu\text{m}$  to 18  $\mu\text{m}$
  - Designed and built multiple integrated opto-electronic prototypes
  - Experience includes
    - Molecular beam epitaxy of III-V and II-VI materials, including quantum cascade lasers
    - III-V and II-VI compound semiconductor micro- and nanofabrication tools and techniques
    - Optoelectronics production packaging
    - C++, MATLAB, and finite element programming and optimization for operational analysis
    - Commercial and self-coded software for electromagnetic, optical, and thermal modeling and simulation
    - Mid-infrared optoelectronic device characterization and analysis for sensing and communication systems
    - Spectroscopic analysis techniques, including Fourier transform infrared (FTIR) spectroscopy
- AdTech Optics, Inc. – City of Industry, CA** *Technical Consultant* **2007**
  - Collaborated on DARPA-funded quantum cascade laser design and development contract for infrared countermeasures
  - Developed instrumentation for automated quantum cascade laser test and analysis systems
  - Authored and performed test procedures for quality assurance of mission critical components
  - Advised on production flow improvements based on broad process knowledge
- National Renewable Energy Laboratory – Golden, CO** *Research Intern* **2003 – 2004**  
*Supervisors: Anne C. Dillon, Ph.D. & Michael J. Heben, Ph.D.*
  - Researched novel approaches to arc-discharge carbon nanotube synthesis
  - Constructed an automated prototype nanotube growth system
  - Synthesized carbon nanotubes through a laser vaporization process
  - Used Raman spectroscopy, transmission electron microscopy, and thermogravimetric analysis characterization techniques
- U.S. Department of Energy, Office of Science – Washington, D.C.** *Student Intern* **Summers 2001 & 2002**  
*Supervisor: Peter Faletra, Ph.D., Assistant Director of the Office of Science*
  - Traveled to ten National Labs assisting University of Washington Center for Workforce Development in internship program review and evaluation, examining program value and customer (intern) satisfaction
  - Advised on strategic direction for individual programs and department mission
  - Editor for first and second volumes of DOE Office of Science Journal of Undergraduate Research, contributing author
  - Worked directly under an Office of Science director in policy-related matters, including program management and Congressional budget proposals

## AWARDS & HONORS

PRINCETON UNIVERSITY Wallace Fellow ( <i>signifying top 20 recognition within PhD cohort</i> )	2008
PRINCETON UNIVERSITY Wu Prize for Excellence	2008
Sigma Xi	2008
IEEE Indium Phosphide and Related Materials Conference Best Student Paper Award	2006
National Science Foundation Graduate Research Fellowship	2004
COLORADO SCHOOL OF MINES Highest Scholastic ( <i>first in class</i> ) Honors	2004
COLORADO SCHOOL OF MINES McBride Honors Program Philipose Senior Award	2004
COLORADO SCHOOL OF MINES Physics Faculty Distinguished Graduate Award	2004
COLORADO SCHOOL OF MINES Dean's Service Award	2004
Tau Beta Pi	2002
American FFA Degree	2000

## ACTIVITIES & ORGANIZATION MEMBERSHIP

PRINCETON UNIVERSITY IEEE Student Chapter Executive Board	2007 – present
PRINCETON UNIVERSITY Graduate Engineering Ambassadors	2005 – present
PRINCETON UNIVERSITY Graduate Engineering Council	2006 – 2007
PRINCETON UNIVERSITY Electrical Engineering Graduate Student Council	2005 – 2006
COLORADO SCHOOL OF MINES Board of Trustees Student Trustee	2003 – 2004
COLORADO SCHOOL OF MINES Society of Physics Students	2002 – 2004
COLORADO SCHOOL OF MINES Student Body (ASCSM) Secretary	2002 – 2003
COLORADO SCHOOL OF MINES McBride Honors Program	2000 – 2004
COLORADO SCHOOL OF MINES Tau Beta Pi Treasurer	2003 – 2004
Optical Society of America (OSA)	2007 – present
American Physical Society (APS)	2003 – present
Institute of Electrical and Electronic Engineers (IEEE)	2002 – present
American Association for the Advancement of Science (AAAS)	2002 – present

## SELECTED SERVICE & OUTREACH

National Science Bowl and National Middle School Science Bowl Moderator	2003 – 2008
National Science Bowl and National Middle School Science Bowl Question Author	2005 – 2008
PRINCETON UNIVERSITY Science and Engineering Expo Volunteer	2005 – 2008
PRINCETON UNIVERSITY prospective graduate student recruitment activities	2005 – 2008

## PATENTS

1. Kale J. Franz and Claire Gmachl, "Excited State Quantum Cascade Photon Source," United States, filed 4 May 2007.
2. Kale J. Franz and Claire Gmachl, "Mid-Infrared Photonic Integration," United States, provisional patent application.
3. Kale J. Franz, Claire Gmachl, Anthony J. Hoffman, and Scott S. Howard, "Heterogeneous Quantum Cascade Lasers with Low Voltage Defect," United States, provisional patent application.
4. Claire Gmachl, Qiang Liu, Anthony Hoffman, Matthew Escarra, Kale Franz, "Highly Power-Efficient Quantum Cascade Lasers," United State, provisional patent application.

## PUBLICATIONS

1. P.Q. Liu, A.J. Hoffman, M.D. Escarra, **K.J. Franz**, J. B. Khurgin, Y. Dikmelik, X.J. Wang, J.-Y. Fan, and C. Gmachl, "Highly power-efficient quantum cascade lasers," *Nature Photonics*, submitted.
2. **K.J. Franz**, M.D. Escarra, A.J. Hoffman, P.Q. Liu, J.J.J. Raftery, S.S. Howard, Y. Dikmelik, J.B. Khurgin, X. Wang, J.-Y. Fan, and Claire Gmachl, "Short Injector Quantum Cascade Lasers," *IEEE Journal of Quantum Electronics*, in press.
3. Y. Yao, **K.J. Franz**, X. Wang, J.-Y. Fan, C. Gmachl, "A widely voltage-tunable quantum cascade laser based on "two-step" coupling," *Applied Physics Letters* **95**, 021105 (2009).
4. M.D. Escarra, A.J. Hoffman, **K.J. Franz**, S.S. Howard, R. Cendejas, X. Wang, J.-Y. Fan, C. Gmachl, "Quantum cascade lasers with voltage defect of less than one longitudinal optical phonon energy," *Applied Physics Letters* **94**, 251114 (2009).
5. A.J. Hoffman, L. Alekseyev, A. Sridhar, P.X. Braun, S.S. Howard, **K.J. Franz**, D. Wasserman, V.A. Podolskiy, E.E. Narimanov, D.L. Sivco, C. Gmachl, "Mid-infrared Semiconductor Optical Metamaterials," *Journal of Applied Physics* **105**, 122411 (2009).
6. Y. Yao, Z.J. Liu, A.J. Hoffman, **K.J. Franz**, C.F. Gmachl, "Voltage Tunability of Quantum Cascade Lasers," *IEEE Journal of Quantum Electronics* **45**, 730 (2009).

7. A. Shen, W.O. Charles, B.S. Li, **K.J. Franz**, C. Gmachl, Q. Zhang, and M.C. Tamargo, "Wide Band Gap II-VI Selenides for Short Wavelength Intersubband Devices," *Journal of Crystal Growth* **311**, 2109 (2009).
8. C.R. Young, R. Cendejas, S.S. Howard, W. Sanchez-Vaynshteyn, A.J. Hoffman, **K.J. Franz**, Y. Yao, B. Mizaikoff, X. Wang, J.-Y. Fan, C. Gmachl "Wavelength selection for quantum cascade lasers by cavity length," *Applied Physics Letters* **94**, 091109 (2009).
9. J.B. Khurgin, Y. Dikmelik, P.Q. Liu, A.J. Hoffman, M.D. Escarra, **K.J. Franz**, C.F. Gmachl "Role of interface roughness in the transport and lasing characteristics of quantum-cascade lasers," *Applied Physics Letters* **94**, 091101 (2009)
10. A.J. Hoffman, P.X. Braun, M.D. Escarra, **K.J. Franz**, X. Wang, C. Gmachl "Lasing-induced reduction of core heating in high wall plug efficiency quantum cascade lasers," *Applied Physics Letters* **94**, 041101 (2009)
11. Y. Yao, **K.J. Franz**, Z. Liu, A.J. Hoffman, C.F. Gmachl, "Voltage tuning of gain spectra in quantum cascade lasers," *Proc. SPIE* **7230**, 723012 (2009).
12. **K.J. Franz**, S. Menzel, A.J. Hoffman, D. Wasserman, J. Cockburn, C. Gmachl, "High k-space lasing in a dual optical transition quantum cascade laser," *Nature Photonics*, **3**, 50 (2008).
13. S.S. Howard, D.P. Howard, A.J. Hoffman, **K.J. Franz**, D.L. Sivco, C. Gmachl, "The effect of injector barrier thickness and doping level on current transport and optical transition width in a  $\lambda \sim 8 \mu\text{m}$  QC structure," *Applied Physics Letters*, **93**, 191107 (2008).
14. W.O. Charles, **K.J. Franz**, A. Shen, A. Zhang, B. Li, Y Gong, G.F. Neumark, C. Gmachl, M.C. Tamargo, "Molecular Beam Epitaxy Growth of  $\text{Zn}_x\text{Cd}_{1-x}\text{Se}/\text{Zn}_x\text{Cd}_y\text{Mg}_{1-x-y}\text{Se}-\text{InP}$  Quantum Cascade Structures," *Journal of Crystal Growth*, **310**, 5380 (2008).
15. W.O. Charles, A. Shen, **K.J. Franz**, C. Gmachl, Q. Zhang, Y. Gong, G.F. Neumark, M.C. Tamargo, "Growth and Characterization of  $\text{Zn}_x\text{Cd}_{1-x}\text{Se}/\text{Zn}_x\text{Cd}_y\text{Mg}_{1-x-y}\text{Se}$  Asymmetric Coupled Quantum Well Structures for Quantum Cascade Laser Applications," *Journal of Vacuum Science & Technology B* **26**, 1171 (2008).
16. **K.J. Franz**, W.O. Charles, A. Shen, A.J. Hoffman, M.C. Tamargo, C. Gmachl, "ZnCdSe/ZnCdMgSe Quantum Cascade Electroluminescence," *Applied Physics Letters*, **92**, 121105 (2008).
17. A.J. Hoffman, S. Schartner, S.S. Howard, **K.J. Franz**, F. Towner, C. Gmachl, "Low voltage-defect quantum cascade Laser with heterogeneous injector regions," *Optics Express*, **15**, 15818 (2007).
18. A.J. Hoffman, L. Alekseyev, S.S. Howard, **K.J. Franz**, D. Wasserman, V.A. Podolskiy, E.E. Narimanov, D.L. Sivco, C. Gmachl, "Negative refraction in semiconductor metamaterials," *Nature Materials*, **6**, 946 (2007).
19. H. Lu, A. Shen, M.C. Tamargo, W. Charles, I. Yokomizo, M. Munoz, Y. Gong, G.F. Neumark, **K.J. Franz**, C. Gmachl, C.Y. Song, H.C. Liu, "Study of intersubband transitions of  $\text{Zn}_x\text{Cd}_{1-x}\text{Se}/\text{Zn}_x\text{Cd}_y\text{Mg}_{1-x-y}\text{Se}$  multiple quantum wells grown by molecular beam epitaxy for midinfrared device applications," *Journal of Vacuum Science & Technology B*, **25**, 1103 (2007).
20. A. Shen, H. Lu, M.C. Tamargo, W. Charles, I. Yokomizo, C.Y. Song, H.C. Liu, S.K. Zhang, X. Zhou, R.R. Alfano, **K.J. Franz**, C. Gmachl, "Intersubband transitions in molecular-beam-epitaxy-grown wide band gap II-VI semiconductors," *Journal of Vacuum Science and Technology B*, **25**, 995 (2007).
21. **K.J. Franz**, D. Wasserman, A.J. Hoffman, D.C. Jangraw, K.-T. Shiu, S.R. Forest, C. Gmachl, "Evidence of cascaded emission in a dual-wavelength Quantum Cascade laser," *Applied Physics Letters*, **90**, 091104 (2007).
22. A. Shen, H. Lu, M.C. Tamargo, W. Charles, I. Yokomizo, **K.J. Franz**, C. Gmachl, S.K. Zhang, X. Zhou, R.R. Alfano, H.C. Liu, "Intersubband absorption in CdSe/ZnCdMgSe self-assembled quantum dot multi-layers," *Applied Physics Letters*, **90**, 071910 (2007).
23. S. Zhang, X. Zhou, A. Shen, W. Wang, R. Alfano, H. Lu, W.O. Charles, I. Yokomizo, M.C. Tamargo, **K.J. Franz**, C. Gmachl, "Optical Properties of Heavily Doped n-type CdSe Quantum Dots for Intersubband Device Applications," *Proceedings of the Materials Research Society*, **959E**, 0959-M06-05 (2006).
24. H. Lu, A. Shen, W. Charles, I. Yokomizo, M.C. Tarmargo, **K.J. Franz**, C. Gmachl, M. Munoz, "Optical characterization of intersubband transitions in  $\text{Zn}_x\text{Cd}_{1-x}\text{Se}/\text{Zn}_x\text{Cd}_y\text{Mg}_{1-x-y}\text{Se}$  multiple quantum well structures," *Applied Physics Letters* **89**, 241921 (2006).
25. **K.J. Franz**, K.-T. Shiu, S.R. Forrest, C. Gmachl, "A dual-wavelength quantum cascade laser with two optical transitions in each active region," *Indium Phosphide and Related Materials Conference Proceedings*, pp. 26-29, (2006).
26. **K.J. Franz**, J.L. Alleman, K.M. Jones, A.C. Dillon, M.J. Heben, "Carbon single-wall nanotube growth in a volumetrically confined arc discharge system," *DOE Journal of Undergraduate Research*, **4**, 66-69, (2004).
27. **K.J. Franz** and P.P. Faletra, "DNA Dilemma: A perspective on U.S. Patent and Trademark Office philosophy concerning life patents," *DOE Journal of Undergraduate Research*, **2**, 25-28, (2002).

## PRESENTATIONS

1. Y. Dikmelik, J.B. Khurgin, P.Q. Liu, A.J. Hoffman, M.D. Escarra, **K.J. Franz**, and C.F. Gmachl, "Limitations to the Wallplug Efficiency of Mid-infrared Quantum Cascade Lasers Imposed by Transport Characteristics," *International Conference on Intersubband Transitions in Quantum Wells (ITQW)*, Montreal, Canada, September, 2009.

2. Y. Yao, **K.J. Franz**, X. Wang, J.-Y. Fan, and C.F. Gmachl, "A Widely Voltage-Tunable Quantum Cascade Laser Design," *International Conference on Intersubband Transitions in Quantum Wells (ITQW)*, Montreal, Canada, September, 2009.
3. P.Q. Liu, A.J. Hoffman, M.D. Escarra, **K.J. Franz**, J.B. Khurgin, Y. Dikmelik, X. Wang, J.-Y. Fan, C.F. Gmachl, "Highly Power-efficient Ultra-strong Coupling Quantum Cascade Lasers," *International Conference on Intersubband Transitions in Quantum Wells (ITQW)*, Montreal, Canada, September, 2009.
4. W.O. Charles, Y. Yao, **K.J. Franz**, Q. Zhang, A. Shen, C. Gmachl, M. C. Tamargo, "Investigations of  $Zn_xCd_{1-x}Se/Zn_xCd_yMg_{(1-x-y)}Se$ -InP Quantum Cascade Laser Structures with Electroluminescence Emission in the 4 to 5  $\mu m$  Range," *International Conference on Intersubband Transitions in Quantum Wells (ITQW)*, Montreal, Canada, September, 2009.
5. P.Q. Liu, A.J. Hoffman, M.D. Escarra, **K.J. Franz**, J.B. Khurgin, Y. Dikmelik, X. Wang, J.-Y. Fan, C.F. Gmachl "Highly Power-Efficient Quantum Cascade Lasers," *Mid-Infrared Coherent Sources (MICS)*, Trouville, France, June 2009.
6. **K.J. Franz**, J.J.J. Raftery, P.Q. Liu, A.J. Hoffman, M.D. Escarra, S.S. Howard, Y. Dikmelik, J.B. Khurgin, X. Wang, J.-Y. Fan, C. Gmachl "Negative Differential Resistance and Pulse Instabilities in Minimalized Quantum Cascade Laser Structures," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
7. A.J. Hoffman, P.X. Braun, M.D. Escarra, S.S. Howard, **K.J. Franz**, X. Wang, J.-Y. Fan, C. Gmachl "Characterizing Quantum Cascade Lasers Using Instantaneous Power and Threshold Measurements," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
8. Y. Yao, **K.J. Franz**, X. Wang, C.F. Gmachl "Widely Voltage Tunable Quantum Cascade Lasers," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
9. M.D. Escarra, A.J. Hoffman, S.S. Howard, **K.J. Franz**, X. Wang, J.-Y. Fan, C.F. Gmachl "Ultra Low Voltage Defect in Quantum Cascade Lasers," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
10. P.Q. Liu, A.J. Hoffman, M.D. Escarra, **K.J. Franz**, J.B. Khurgin, Y. Dikmelik, X. Wang, J.-Y. Fan, C.F. Gmachl "Quantum Cascade Lasers with Ultra-Strong Coupling Injection," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
11. Y. Dikmelik, J.B. Khurgin, P.Q. Liu, M.D. Escarra, A.J. Hoffman, **K.J. Franz**, C.F. Gmachl, X. Wang "Intersubband Absorption Loss in High-Performance Mid-Infrared Quantum Cascade Lasers," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
12. C.R. Young, R. Cendejas, S.S. Howard, W. Sanchez-Vaynshteyn, **K.J. Franz**, Y. Yao, B. Mizaikoff, X. Wang, J.-Y. Fan, and C. Gmachl "Wavelength Selection for Quantum Cascade Lasers by Cavity Length," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009.
13. **K.J. Franz**, P.Q. Liu, A. J. Hoffman, S.S. Howard, M.D. Escarra, Y. Dikmelik, J.G. Khurgin, X. Wang, J.-Y. Fan, C. Gmachl, "Short Injector Regions for Improved Quantum Cascade Laser Performance," *International Quantum Cascade Laser School and Workshop (IQCLSW)*, Monte Verita, Switzerland, Sept 2008. **invited**
14. W.O. Charles, **K.J. Franz**, A. Shen, Q. Zhang, C. Gmachl, M.C. Tamargo, "Growth and Characterization of  $Zn_xCd_{1-x}Se/Zn_xCd_yMg_{1-x-y}Se$  Quantum Cascade Emitters," poster presentation, *International Quantum Cascade Laser School and Workshop (IQCLSW)*, Monte Verita, Switzerland, Sept 2008.
15. M.D. Escarra, A.J. Hoffman, S.S. Howard, **K.J. Franz**, X. Wang, M Fong, C.F. Gmachl, "Improved Voltage Efficiency in Quantum Cascade Lasers," poster presentation, *International Quantum Cascade Laser School and Workshop (IQCLSW)*, Monte Verita, Switzerland, Sept 2008.
16. Y. Yao, Z. Liu, A.J. Hoffman, **K.J. Franz**, and C.F. Gmachl, "Voltage tunability of quantum cascade lasers," poster presentation, *International Quantum Cascade Laser School and Workshop (IQCLSW)*, Monte Verita, Switzerland, Sept 2008.
17. **K.J. Franz**, W.O. Charles, A. Shen, A.J. Hoffman, M.C. Tamargo, C. Gmachl, "Quantum Cascade Electroluminescence from a  $ZnCdSe/ZnCdMgSe$  on InP Structure," *Mid-Infrared Optoelectronics Materials and Devices (MIOMD) IX*, Freiburg, Germany, Sept 2008.
18. A.J. Hoffman, M.D. Escarra, S.S. Howard, **K.J. Franz**, X. Wang, J.-Y. Fan, C. Gmachl, "Strategies for Improved Wall-plug Efficiency in Quantum Cascade Lasers," *Mid-Infrared Optoelectronics Materials and Devices (MIOMD) IX*, Freiburg, Germany, Sept 2008.
19. A. Shen, W.O. Charles, B.S. Li, **K.J. Franz**, C. Gmachl, Q. Zhang, M.C. Tamargo, "Wide Band Gap II-Selenides for Short Wavelength Intersubband Devices," *International Conference on Molecular Beam Epitaxy*, Vancouver, Canada, August 2008.
20. **K.J. Franz**, S. Menzel, D. Wasserman, A.J. Hoffman, J.W. Cockburn, C. Gmachl, "High  $k$ -Space Lasing in Excited State Quantum Cascade Lasers," *International Conference on the Physics of Semiconductors (ICPS)*, Rio de Janeiro, Brazil, July 2008.
21. **K.J. Franz**, W.O. Charles, A. Shen, A.J. Hoffman, M.C. Tamargo, C. Gmachl, "Electroluminescence from a  $ZnCdSe/ZnCdMgSe$  Quantum Cascade Structure," poster presentation, *International Conference on the Physics of Semiconductors (ICPS)*, Rio de Janeiro, Brazil, July 2008.

22. Y. Dikmelik, J.B. Khurgin, A.J. Hoffman, S.S. Howard, **K.J. Franz**, C.F. Gmachl, "Excited-State Absorption in High-Power Mid-Infrared Quantum Cascade Lasers," poster presentation, *Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2008.
23. **K.J. Franz**, W.O. Charles, A. Shen, A.J. Hoffman, M.C. Tamargo, C. Gmachl, "Intersubband Electroluminescence from a ZnCdSe/ZnCdMgSe Quantum Cascade Structure," *Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2008.
24. S. Menzel, **K.J. Franz**, D. Wasserman, A.J. Hoffman, J.W. Cockburn, C.F. Gmachl, "Laser Action at High k-Space Values in Anti-Correlated Multi-Wavelength Quantum Cascade Lasers," *Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2008.
25. A.J. Hoffman, S. Schartner, S.S. Howard, **K.J. Franz**, F. Towner, C. Gmachl, "Low Voltage Defect Heterogeneous Quantum Cascade Laser," *Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2008.
26. M.A. Talukder, F.-S. Choa, C.R. Menyuk, **K.J. Franz**, S.S. Howard, C.F. Gmachl, "Novel Heat Removal Waveguide Structure for High Performance Quantum Cascade Lasers," poster presentation, *Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2008.
27. W.O. Charles, **K.J. Franz**, A. Shen, M.C. Tamargo, C. Gmachl, "Growth and properties of wide band gap II-VI multi-quantum well structures for mid-infrared quantum cascade lasers," *American Physical Society March Meeting*, New Orleans, LA, Mar 2008.
28. M.D. Escarra, A.J. Hoffman, S.S. Howard, **K.J. Franz**, A. Sridhar, C. Gmachl, "High Efficiency Quantum Cascade Lasers," *American Physical Society March Meeting*, New Orleans, LA, Mar 2008.
29. **K.J. Franz**, S. Menzel, A.J. Hoffman, D. Wasserman, J. Cockburn, C. Gmachl, "Excited State Quantum Cascade Lasers and Lasing in k-Space," *PRISM/PCCM/MIRTHE Industry Day*, Princeton, NJ, Mar 2008.
30. **K.J. Franz**, S. Menzel, A.J. Hoffman, D. Wasserman, J.W. Cockburn, C. Gmachl, "High k-Space Lasing in a Dual Optical Transition Quantum Cascade Laser," poster presentation, *15th International Winterschool on New Developments in Solid State Physics*, Bad Hofgastein, Salzburg, Austria, Feb 2008.
31. **K.J. Franz**, A.J. Hoffman, S.S. Howard, Z.J. Liu, S. Menzel, S. Schartner, D. Wasserman, C. Gmachl, "Mid-Infrared Quantum Cascade Lasers," *15th International Winterschool on New Developments in Solid State Physics*, Bad Hofgastein, Salzburg, Austria, Feb 2008.
32. A.J. Hoffman, S. Schartner, S.S. Howard, **K.J. Franz**, F. Towner, C. Gmachl, "Low-Voltage Defect Quantum Cascade Laser with Heterogeneous Injector Regions," *IEEE LEOS Annual Meeting*, Lake Buena Vista, FL, Oct 2007.
33. W.O. Charles, A. Shen, **K.J. Franz**, C. Gmachl, Q. Zhang, Y. Gong, G.F. Neumark, M.C. Tamargo, "Asymmetric Coupled Quantum Well Structure for Quantum Cascade Laser Applications," *North American Conference on Molecular Beam Epitaxy (NAMBE)*, Albuquerque, NM, Sept 2007.
34. **K.J. Franz**, S. Menzel, A.J. Hoffman, D. Wasserman, K.-T. Shiu, S.R. Forrest, C. Gmachl, "Excited State Optical Transitions in Quantum Cascade Lasers for Low Thresholds and Multi-Wavelength Emission," *International Conference on Intersubband Transitions in Quantum Wells (ITQW)*, Ambleside, Cumbria, U.K., Sept 2007.
35. S.S. Howard, A.J. Hoffman, **K.J. Franz**, T. Ko, C. Gmachl, "Current Injection Transition Broadening in Quantum Cascade Lasers," *International Conference on Intersubband Transitions in Quantum Wells (ITQW)*, Ambleside, Cumbria, U.K., September, 2007.
36. **K.J. Franz**, D. Wasserman, A.J. Hoffman, K.-T. Shiu, S.R. Forrest, C. Gmachl, "Cascaded Emission in a Dual-Wavelength Quantum Cascade Laser," *Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, May 2007.
37. **K.J. Franz**, D. Wasserman, A.J. Hoffman, K.-T. Shiu, S.R. Forrest, C. Gmachl, "Cascaded Emission in a Dual-Wavelength Quantum Cascade Laser," *PRISM/PCCM/MIRTHE Industry Day*, Princeton, NJ, Mar 2007.
38. **K.J. Franz**, K.-T. Shiu, S.R. Forrest, C. Gmachl, "Monolithic Mid-Infrared Integration of a Quantum Cascade Laser and a Passive Semiconductor Waveguide," *American Physical Society March Meeting*, Denver, CO, Mar 2007.
39. S. Zhang, X. Zhou, A. Shen, W. Wang, R. Alfano, H. Lu, W.O. Charles, I. Yokomizo, M.C. Tamargo, **K.J. Franz**, C. Gmachl, "Optical Properties of Heavily Doped n-type CdSe Quantum Dots for Intersubband Device Applications," *MRS Fall Meeting*, Boston, MA, Nov 2006.
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