

# Arvind P. Ravikumar

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*Updated:*      April 2022

ACADEMIC AND EMPLOYMENT HISTORY

**The University of Texas at Austin**, September 2021 – present  
*Research Associate Professor, Petroleum and Geosystems Engineering*

**Colorado School of Mines**, January 2018 – present  
*Fellow, The Payne Institute for Public Policy*

**Johns Hopkins University**, January 2018 – present  
*Fellow, Initiative for Sustainable Energy Policy, School of Advanced and International Studies*

**Harrisburg University of Science & Technology**, September 2018 – August 2021  
*Assistant Professor of Energy Engineering, Department of Systems Engineering*  
*Faculty Fellow, Center for Environment, Energy, and Economy*

**Stanford University**, October 2015 – August 2018  
*Postdoctoral Fellow, Department of Energy Resources Engineering*  
*Fellow, Woods Institute for the Environment*  
Advisor: Adam Brandt

EDUCATION

**Princeton University**, September 2010 – August 2015  
*Ph.D., M.A., Electrical Engineering*  
*Senior Fellow, The McGraw Center for Teaching and Learning*  
*Fellow, Princeton Energy and Climate Scholars, Princeton Environmental Institute*  
Advisor: Claire Gmachl

**Birla Institute of Technology and Science, Pilani**, July 2005 – June 2010  
*B.E., Electrical Engineering*  
*M.Sc., Physics*

RESEARCH INTERESTS

My research group, the **Sustainable Energy Transition Lab**, focuses on developing technical, social, and policy solutions to effective climate action in the global energy sector through a combination of field work, modeling, and policy design. Specific topics include:

- Methane emissions from oil and gas operations: Measurements, Models, and Policies
- Fugitive Emissions Abatement Simulation Tool (FEAST) model development
- Oil and gas supply chain emissions assessment
- Implications of energy transitions on the oil and gas sector

CURRENT AND PENDING SUPPORT

11 Cheniere Inc. *Quantification, measurement, record-keeping, and verification protocols for long-term, supply-chain methane emissions management.* 2021–2024.

10 Environmental Defense Fund (EDF). *FEAST-based assessment of new technologies to mitigate methane emissions from the U.S. oil and gas sector (P.I.).* 2021–2023.

9 New York State Energy Research and Development Authority (NYSERDA). *Midstream Methane Emissions Characterization and Technology Assessment in NY (P.I.).* 2021–2024.

- 8 International Association of Oil & Gas Producers (IOGP). *Recommended Practices for Methane Emissions Detection at Oil and Gas Facilities (co-P.I.)*. 2020–2021.
- 7 U.S. Department of Energy DE-FOA-0002006. *Accelerating natural gas leak detection and quantification solutions through transparent and rigorous scientific validation (co-P.I.)* 2020–2023.
- 6 Consortium of Energy Industry. *Path to Equivalence - Accelerating the future of leak detection (co-P.I.)*. 2019–2022.
- 5 Alberta Upstream Petroleum Research Fund. *Alberta Methane Field Challenge 2.0 - evaluating new methane leak detection technologies (P.I.)*. 2020–2021.
- 4 Alberta Upstream Petroleum Research Fund. *Alberta Methane Field Challenge 1.0 - evaluating new methane leak detection technologies (P.I.)*. 2019–2020.
- 3 Gas Technology Institute. *FEAST-based approach to methane emissions mitigation in urban distribution systems (P.I.)*. 2019–2020.
- 2 Alberta Upstream Petroleum Research Fund. *Alternative-technologies for fugitive methane emissions management (P.I.)*. 2019–2020.
- 1 Alberta Upstream Petroleum Research Fund. *Fugitive emissions management program effectiveness assessment in the Red Deer area (P.I.)*. 2018–2020.

PAST FUNDING &  
AWARDS

- 11 Alberta Upstream Petroleum Research Fund. *pre-proposal grant* Co-wrote with post-doctoral advisor, Jan–Apr 2018.
- 10 Sponsored project with Seven-Generations Energy Ltd., Alberta, Calgary (co-wrote with post-doctoral advisor), 2017–2018.
- 9 Stanford Natural Gas Initiative and Environmental Defense Fund, Mobile Monitoring Challenge (co-wrote with post-doctoral advisor), 2017–2018.
- 8 National Science Foundation, Accelerating Innovation Research: Technology Translation (AIR:TT) program (co-wrote with Ph.D. advisor) 2014–2015.
- 7 National Science Foundation grant for student-led independent project, Princeton University, 2014–2015.
- 6 Newport graduate award in Photonics, Princeton University, 2015.
- 5 Outstanding teaching assistant award, Electrical Engineering, Princeton University, 2015.
- 4 Graduate teaching fellowship, McGraw Center for Teaching and Learning, Princeton University, 2014.
- 3 III-place, 8<sup>th</sup> Annual Innovation Forum, Keller Center for Innovation, Princeton University, 2013.
- 2 Princeton Climate and Energy Scholars Research Grant, Princeton Environmental Institute, 2014–2015.
- 1 Princeton University Engineering fellowship, 2010–2011.

PEER-REVIEWED  
PUBLICATIONS

Underlined names are Ph.D. students or post-doctoral scholars I mentored (current and past).

Citations: [Google Scholar Page](#)

h-index = 16

i10-index = 23

- 40 **Ravikumar, A.P.**, Bazilian, M., and Webber, M.E. (2022). The US role in securing European Union’s near-term natural gas supplies. *in revision Nature Energy*.
- 39 Yang, S., Hastings-Simon, S., and **Ravikumar, A.P.** (2022). Pipeline availability limits on the feasibility of global coal-to-gas switching in the power sector. *in review*.
- 38 **Ravikumar, A.P.**, Baker, E., Bates, A., Nock, D., Venkataraman, D., Johnson, T., Ash, M., Attari, S.Z., Bowie, K., Carley, S., Castellanos, S., Cha, M., Clark, D.L., Deane-Ryan, D., Djokic, D., Ford, J.C., Goldstein, A., Grubert, E., Hu, L., Kammen, D.M., Kosar, U., Miller, C., Pastor, M., and Tuominen, M. (2022). Enabling an equitable energy transition through inclusive research.

*in review.*

- 37 Jordaan, S.M., Ruttinger, A.W., Surana, K., Nock, D., Miller, S.M., and **Ravikumar, A.P.** (2022). Global mitigation opportunities for the life-cycle of natural gas-fired power. *in revision Nature Climate Change*.
- 36 Bauer, C., Treyer, K., Antonini, C., Bergerson, J., Gazzani, M., Gencer, E., Gibbins, J., Mazzotti, M., McCoy, S.T., McKenna, R., Pietzker, R., **Ravikumar, A.P.**, Romano, M.C., Ueckerdt, F., Vente, J., and Spek, M. (2022). **On the climate impacts of blue hydrogen production.** *Sustainable Energy & Fuels*. **6** 66.
- 35 Kemp, C., and **Ravikumar, A.P.** (2021). **New technologies can significantly reduce the cost of addressing methane emissions from the oil and gas Industry.** *Environmental Science & Technology* **55** 9140.
- 34 Wang, J., Jingwei, J., **Ravikumar, A.P.**, Saravese, S., and Brandt, A.R. (2021). **VideoGasNet: Deep learning for natural gas methane leak classification using an infrared camera.** *Energy* **238** 121516.
- 33 Wang, J., Barlow, B., Robinson, C., Funk, W., Brandt, A.R., and **Ravikumar, A.P.** (2021). **Large-scale controlled experiment demonstrate effectiveness of methane leak detection and repair programs at oil and gas facilities.** *in review*.
- 32 Yang, S., Hastings-Simon, S., and **Ravikumar, A.P.** (2021). **Global Liquefied Natural Gas industry expansion may imperil Paris Agreement temperature targets.** *in revision at Environmental Research Letters*.
- 31 Sherwin, E.D., Chen, Y., **Ravikumar, A.P.**, and Brandt, A.R. (2021). **Single-blind test of airplane-based hyperspectral methane detection via controlled releases.** *Elementa: Science of the Anthropocene* **9** 00063.
- 30 Rutherford, J.S., Sherwin, E.D., **Ravikumar, A.P.**, Heath, G., Englander, J., Cooley, D., Lyon, D., Omara, M., Langfitt, Q., and Brandt, A.R. (2021). **Closing the gap: Explaining persistent underestimation by US oil and natural gas production-segment methane inventories.** *Nature Communications* **12** 4715.
- 29 Liu, R.E., Bergerson, J.A., **Ravikumar, A.P.**, Nie, Y., Brandt, A.R., Woloschuk, K., Zhang, S., and Bi, T. (2021). **Greenhouse Gas Emissions of Western Canadian Natural Gas: Proposed Emissions Tracking for Life Cycle Modeling.** *Environmental Science & Technology* **55** 9711.
- 28 Singh, D., Barlow, B., Hugenholtz, H., Funk, W., Robinson, C., and **Ravikumar, A.P.** (2021). **Field performance of new methane detection technologies: Results from the Alberta Methane Field Challenge.** *in review at Environmental Science & Technology Engineering*.
- 27 Wang, J., Nadarajah, S., Wang, J., and **Ravikumar, A.P.** (2020). **A machine learning approach to methane emissions mitigation in the oil and gas industry.** NeurIPS 2020 Workshop on Tackling Climate Change with AI. **Best Overall Paper Award**
- 26 Nie, Y., Zhang, S., Liu, R.E., Roda-Stuart, D., **Ravikumar, A.P.**, Bradley, A., Masnadi, M.S., Brandt, A.R., Bergerson, J., and Bi, X.T. (2020). **Greenhouse-gas emissions of Canadian liquefied natural gas for use in China: Comparison and synthesis of three independent life cycle assessments.** *Journal of Cleaner Production* **258** 120701.
- 25 Klise, K.A., Nicholson, B.L., Laird, C.D., **Ravikumar, A.P.**, and Brandt, A.R. (2020). **Sensor placement optimization software applied to site-scale methane emissions monitoring.** *Journal of Environmental Engineering*. **146** 04020054.
- 24 Wang, J., Tchapmi, L.P., **Ravikumar, A.P.**, McGuire, M., Bell, C., Zimmerle, D., and Brandt, A.R. (2020). **Machine vision for natural gas methane emissions detection using an infrared camera.** *Applied Energy* **257** 113998.
- 23 **Ravikumar, A.P.**, Roda-Stuart, D., Liu, R., Bradley, A., Bergerson, J., Nie, Y., Zhang, S., Bi, X., and Brandt, A.R. (2019). **Repeated Leak Detection and Repair Surveys Reduce Methane Emissions Over Scale of Years.** *Environmental Research Letters* **15** 034029.

- 22 Lyman, S.N., Tran, T., Mansfield, M.L., and **Ravikumar, A.P.** (2019). Comparison of optical gas imaging surveys at oil and gas wells in Utah. *Elementa: Science of the Anthropocene* **7** 43.
- 21 **Ravikumar, A.P.**, Sreedhara, S., Wang, J., Englander, J., Roda-Stuart, D., Bell, C., Zimmerle, D., Lyon, D., Mogstad, I., Ratner, B., and Brandt, A.R. (2019). Single-blind inter-comparison of methane detection technologies – results from the Stanford/EDF Mobile Monitoring Challenge. *Elementa: Science of the Anthropocene* **7** 37.
- 20 Fox, T., **Ravikumar, A.P.**, Hugenholtz, C.H., Zimmerle, D., Barchyn, T.E., Johnson, M.R., Lyon, D., and Taylor, T. (2019). A methane emissions reduction equivalence framework for alternative leak detection and repair programs. *Elementa: Science of the Anthropocene* **7** 30.
- 19 Fox, T., Barchyn, T., Risk, D., **Ravikumar, A.P.**, and Hugenholtz, C. (2019). A review of current and emerging technologies for monitoring methane emissions in upstream oil and gas. *Environmental Research Letters* **14** 053002.
- 18 **Ravikumar, A.P.**, Wang, J., McGuire, M., Bell, C., Zimmerle, D., and Brandt, A.R. (2018). Good versus Good Enough? Empirical tests of methane leak detection sensitivity of a commercial infrared camera. *Environmental science & Technology* **52** 2368.
- 17 **Ravikumar, A.P.**, Brandt, A.R. (2017). Designing better methane mitigation policies: the challenge of distributed small sources in the natural gas sector. *Environmental Research Letters* **12** 044023.  
Media Coverage: Anthropocene Magazine, E&E News, Natural Gas Intel, SF Gate, Houston Chronicle, IEEE Spectrum
- 16 **Ravikumar, A.P.**, Wang, J., Brandt, A.R. (2017). Are optical gas imaging technologies effective for methane leak detection? *Environmental Science & Technology* **51** 718.
- 15 Kaya, Y., **Ravikumar, A.P.**, Chen, G., Tamargo, M.C, Shen, A., and Gmachl, C.F. (2017). Two band ZnCdSe/ZnCdMgSe quantum well infrared photodetector. *AIP Advances* **8** 075105.
- 14 **Ravikumar, A.P.**, Sivco, D., Gmachl, C.F. (2016). Wavelength independent normal-incidence detection for intersubband infrared detectors. *Optics Express* **24** 25269.
- 13 Kemp, C.E., **Ravikumar, A.P.**, Brandt, A.R. (2016). Comparing natural gas leakage detection technologies using an open-source ‘virtual gas field’ simulator. *Environmental Science & Technology* **40** 4546.
- 12 Garcia, T.A., **Ravikumar, A.P.**, Tamargo, M.C., Gmachl, C.F. (2016). II-VI quantum cascade emitters in the 6-8  $\mu\text{m}$  range. *Physica Status Solidi B* **253** 1494.
- 11 Chen, G., Kaya, Y., **Ravikumar, A.P.**, Tamargo, M.C., Gmachl, C.F. (2015). Growth and characterization of ZnCdSe/ZnCdMgSe two-color quantum well infrared photodetectors. *Physica Status Solidi C* **13** 673.
- 10 **Ravikumar, A.P.**, De Jesus, J., Tamargo, M.C., Gmachl, C.F. (2015). II-VI based mid-infrared broadband quantum cascade detector. *Applied Physics Letters* **107** 141105.
- 9 Wolf, O., Campione, S., Benz, A., **Ravikumar, A.P.**, Liu, S., Kadlec, E.A., Shaner, E.A., Klem, J.F., Sinclair, M.B., Brener, I. (2015). Phased-array sources based on non-linear metamaterial nanocavities. *Nature Communications* **6** 7667.
- 8 **Ravikumar, A.P.**, Garcia, T.A., De Jesus, J., Tamargo, M.C., Gmachl, C. (2014). High detectivity short wavelength II-VI quantum cascade detector. *Applied Physics Letters* **105** 051113.
- 7 **Ravikumar, A.P.**, Chen, G., Zhao, K., Tian, Y., Prucnal, P., Tamargo, M.C., Gmachl, C.F., Shen, A. (2013). Room temperature and high responsivity II-VI short wavelength quantum well infrared photodetector. *Applied Physics Letters* **102** 161107.
- 6 Shen, A., **Ravikumar, A.P.**, Chen, G., Zhao, K., Alfaro-Martinez, A., Garcia, T., De Jesus, J., Tamargo, M.C., Gmachl, C. (2013). MBE growth of ZnCdSe/ZnCdMgSe quantum-well infrared photodetectors. *Journal of Vacuum Science & Technology B* **31** 03C113.

- 5 De Jesus, J., Garcia, T.A., Dhomkar, S., **Ravikumar, A.P.**, Gmachl, C., Shen, A., Ferizovic, D., Munoz, M., Tamargo, M.C. (2013). **Characterization of three-well active region of a quantum cascade laser using contactless electroreflectance.** *Journal of Vacuum Science & Technology B* **31** 03C134.
- 4 Garcia, T.A., Hong, S., Gao, Y., Tamargo, M., De Jesus, J., Deligiannakis, V., **Ravikumar, A.P.**, Gmachl, C., Shen, A. (2013). **Improved electrical properties and crystalline quality of II-VI heterostructures for quantum cascade lasers.** *Journal of Vacuum Science & Technology B* **31** 03C133.
- 3 **Ravikumar, A.P.**, Alfaro-Martinez, A., Chen, G., Zhao, K., Tamargo, M.C., Gmachl, C.F., Shen, A. (2012). **ZnCdSe/ZnCdMgSe quantum well infrared photodetector.** *Optics Express* **20** 22391.
- 2 Dhara, S., Solanki, H.S., **Ravikumar, A.P.**, Singh, V., Sengupta, S., Chalke, B.A., Dhar, A., Gokhale, M., Bhattacharya, A., Deshmukh, M.M. (2011). **Tunable thermal conductivity in defect engineered nanowires at low temperatures.** *Physical Review B* **84** 121307.
- 1 Dhara, S., Sengupta, S., Solanki, H.S., Maurya, A., **Ravikumar, A.P.**, Gokhale, M.R., Bhattacharya, A., Deshmukh, M.M. (2011). **Facile fabrication of lateral nanowire wrap-gate devices with improved performance.** *Applied Physics Letters* **99** 173101.

**Media Coverage** NPR Marketplace, Bloomberg, BBC World Service, Rolling Stone, MIT Technology Review, Wall Street Journal, Guardian, Texas Tribune, ABC News, KQED, Wired, Politico, Resources Radio

- POLICY MEMOS & TESTIMONY**
- 5 Ravikumar, A.P. (2019). **PA Senate Democratic Policy Committee Hearing.** Testimony on addressing climate change in Pennsylvania by controlling methane emissions. Pittsburgh, PA.
  - 4 Ravikumar, A.P. (2019). **PA House Democratic Policy Committee Hearing.** Testimony on the impact of methane leakage from Pennsylvania’s oil and gas industry on climate change. Haver-town, PA.
  - 3 Ravikumar, A.P., and Lyon, D. (2018). **Impact of survey frequency on emissions mitigation at oil and gas sites.** *U.S. Environmental Protection Agency on New Source Performance Standards. Docket ID: EPA-HQ-OAR-2017-0483.*
  - 2 Pomerantz, A.E., Wood, D., Germain, S., Mahapatra, O., Kleinberg, R.L., Zimmerle, D., Raviku-mar, A.P., and Brandt, A. (2018). Enabling innovation to reduce methane emissions from the oil and gas industry. *U.S. Environmental Protection Agency on New Source Performance Standards. Docket ID: EPA-HQ-OAR-2017-0483.*
  - 1 Ravikumar, A.P., and Englander, J. (2018). Equivalency between Environment and Climate Change Canada’s final methane regulations and Alberta Energy Regulator’s proposed regulations. *Draft Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting.*

- STUDENTS SUPERVISED**
- Post-doctoral Scholars
    - 4 S. Yang (2019–present)
    - 3 Z. Li (2020–2021), now at *Environmental Defense Fund*
    - 2 D. Singh (2019–2021), now at *Environmental Defense Fund*
    - 1 C. Kemp (2018 – 2021), now at *Assistant Professor of Sustainable Energy at the University of Alaska, Fairbanks*
  - Ph.D. and Masters’ Students
    - 6 J. Wang (2018–present, through Harrisburg University of Science and Technology)
    - 5 Y. Zhu (2021–present)
    - 4 V. Vallejo (2021–present)
    - 3 A. Strayer (starting Fall 2022)
    - 2 O. Amieyeofori (2021 – present)

- 1 D. Roda-Stuart (2017–2018, through Stanford University)
- Undergraduate Students
  - 7 M. Jean-Marie (Class of 2022, Harrisburg University)
  - 6 A. Ramos (Class of 2023, Harrisburg University)
  - 5 J. Jagdeo (Class of 2021, University of Florida)
  - 4 M. Miccioli (Class of 2021, Stanford University)
  - 3 S. Spears (Class of 2022, Stanford University)
  - 2 G. Murrone (Class of 2016, Princeton University)
  - 1 A. Goel (Class of 2015, Princeton University)

LEADERSHIP AND  
PROFESSIONAL  
SERVICE

- **Editorial Roles**
  - Editorial Advisory Board, Energy Findings, 2022 – present
  - Associate Editor, Elementa: Science of the Anthropocene, 2019 – present
  - Review Editor, Frontiers in Sustainability, 2020 – present
- **Advisory Roles**
  - Gas Pipeline Advisory Committee, Pipeline Hazardous Materials Safety Administration, US Department of Transportation *nominated to serve as an independent academic expert by the Secretary of Transportation*
  - Program Advisory Committee, Canadian Emissions Reductions Innovation Network, Petroleum Technology Alliance Canada
  - Technical Advisory Panel, Pipeline and Hazardous Materials Safety Administration
  - Working Group on Technology Equivalence, Environment and Climate Change Canada (University of Calgary)
- **Grant Agency Review Panels**
  - National Science Foundation (NSF)
  - National Oceanic and Atmospheric Administration (NOAA)
  - Natural Sciences and Engineering Research Council (Canada)
  - MITACS (Non-profit, Canada)
- **Conference Program Committees**
  - INFORMS Annual Meeting, 2019 – 2021
  - American Geophysical Union Fall Meeting, 2017 – present
  - Conference on Lasers and Electro-Optics (CLEO) Program Committee, 2018 – 2021
  - AWMA Air Quality Measurement Methods and Technology Conference Program Committee, 2019
- **Harrisburg University academic service**
  - Member, ISEM Program Review Committee, 2021
  - Graduate Research Group - university-wide committee to expand HU’s research infrastructure, 2019 – present
- **Stanford University academic service**
  - Post-doctoral representative, School of Earth Sciences Strategic Planning Initiative, 2017–2018
  - Rising Environmental Leaders Program, Woods Institute for the Environment
  - Facilitator, Management Matters workshop, Vice-Provost for Graduate Education
- **Princeton University academic service**



- Founder and Associate Editor, [Highwire Earth](#), 2015–2017
- [McGraw Center for Teaching and Learning](#): Senior graduate teaching fellow, 2014–2015
- Committee Member, President’s task force on diversity, inclusion and equity, 2014–2015
- Executive committee, Council of the Princeton University Community, 2014–2015
- Steering committee, Princeton Institute for the Science and Technology of Materials (PRISM) Cleanroom User Group, 2012–2014
- Graduate student council, Department of Electrical Engineering

POPULAR  
MEDIA

- 7 The Phoenix (2021). [A conversation with meteorologist and journalist Eric Holthaus on just transitions in the oil and gas sector.](#)
- 6 MIT Technology Review (2020). [Carbon border taxes are unjust.](#)
- 5 Axios (2019). [EPA’s relaxed methane regulations could cost new energy jobs](#) (co-written with M. Bazilian).
- 4 The Conversation Canada (2018). [How to make the liquefied natural gas industry more sustainable?](#)
- 3 Natural Gas Policy Brief, Stanford Natural Gas initiative (2018). [Getting to zero - eliminating methane emissions from the oil and gas industry.](#)
- 2 Natural Gas Policy Brief, Stanford Natural Gas initiative (2018). [Seeing across scales - understanding methane emissions from the U.S. gas industry by integrating a variety of real-world measurements.](#)
- 1 The Conversation U.S. (2017). [Tetecting methane leaks with infrared cameras: They’re fast by are they efficient?](#)

INVITED TALKS  
& SEMINARS

- 57 The Payne Institute for Public Policy, Colorado School of Mines. *Can we Finally Solve the Methane Challenge?* March 2022.
- 56 British Columbia Methane Research Workshop. *The Role of New Technologies in Methane Emissions Leak Detection and Repair Programs.* January 2022.
- 55 American Geophysical Union Fall Meeting. *Temporal Variations in Methane Emissions from Midstream Natural Gas Infrastructure.* December 2021.
- 54 Center for Energy and Environment Research Webinar Series, The University of Texas at Austin. *The FEAST Modeling Framework: Deploying New Technologies for Cost-Effective Methane Emissions Reductions.* December 2021.
- 53 Center of Subsurface Energy and the Environment, The University of Texas at Austin. *Surviving the Energy Transition: Methane Emissions Mitigation in the Oil and Gas Sector.* December 2021.
- 52 Center for Strategic and International Studies, Energy Futures Forum 2021. *Robust Upstream Emissions Monitoring Necessary for any Claim to Low Emission Fossil Fuels.* November 2021.
- 51 Bureau of Ocean Energy Management, Energy Transition for Petroleum Professionals Guest Seminar. *Surviving the Energy Transition: Sustainability in the Oil and Gas Industry.* October 2021.
- 50 Rice University, Department of Civil & Environmental Engineering Seminar. *The Role of Liquefied Natural Gas in a Carbon Constrained World.* October 2021.
- 49 The University of Texas at Austin, Petroleum & Geosystems Engineering Grad Seminar Series. *The Future of Energy: Sustainability in the Oil & Gas Sector.* September 2021.
- 48 Interstate Natural Gas Association of America. *Addressing Methane Emissions from Midstream Transmission and Storage Compressor Station.* September 2021.
- 47 AAAS Center for Scientific Evidence in Public Issues. *Anticipating Changes in Federal Methane Emissions Standards for Oil and Gas Operations.* September 2021.

- 46 U.S. EPA Methane Technology Workshop. *FEAST-based Evaluation of Methane Leak Detection and Repair Programs Using New Technologies*. August 2021.
- 45 The Atlantic Council Roundtable. *Global LNG Expansion Exceeds Demand for Coal-to-gas Switching in Paris Compliant Pathways*. June 2021.
- 44 Cheniere Supplier Meeting. *State of Methane Emissions Monitoring: How Do You Choose the 'Right' Technology?* May 2021.
- 43 METEC Industry Advisory Board Meeting. *Introduction to FEAST 3.1: Evaluating New Methane Emissions Detection Technologies*. May 2021.
- 42 European Commission Workshop on a Regulatory Approach on Leak Detection and Repair of Methane Emissions in the Oil and Gas Sectors. *The next generation of methane mitigation policies: how new technologies will revolutionize global natural gas trade*. March 2021.
- 41 Stanford Natural Gas Initiative Methane Symposium. *Leak detection and repair of the future*. February 2021.
- 40 Climate Series e-Sessions, Society of Petroleum Engineers. *Detection vs quantification technologies: Standardization and Best Practices in development*. February 2021.
- 39 U.S. Environmental Protection Agency virtual webinar. *Introduction to FEAST 3.1: Pathway to Equivalence Project*. February 2021.
- 38 Energy Seminar Series, North Carolina State University. *Friends or Foes: Understanding the Role of Natural Gas in the Biden-Harris Administration's Climate Agenda*. February 2021.
- 37 Methane Connections Meeting, Gas Technology Institute (Panelist). *How can we compare leak detection technologies and work practices? Update on FEAST, MEET, the pathway to equivalence projects*. Virtual. November 2020.
- 36 U.S. Environmental Protection Agency Optical Gas Imaging Stakeholder Workshop. *Variability in real-world performance of OGI-based leak detection surveys*. Virtual. November 2020.
- 35 Methane Emissions Technology Alliance Seminar Series, Stanford University. *Persistence of promise: Can new technologies revolutionize methane emissions mitigation?*. Virtual. October 2020.
- 34 The Payne Institute Fall Webinar Series, Colorado School of Mines. *Is the expansion in the global LNG industry compatible with Paris climate targets?* Virtual. October 2020.
- 33 U.S. LNG Climate Workshop. *Methane emissions , LNG, and the future of natural gas in a decarbonized world*. Virtual. April 2020.
- 32 European Union Delegation to the United States, Workshop on methane emissions. *Evaluation methods for new methane emission detection technologies*. Washington DC. February 2020.
- 31 Methane Emissions Reduction Forum, Petroleum Technology Alliance Canada. *What do recent field studies tell us about effective methane mitigation policy?* (panelist). Banff, AB, Canada. November 2019.
- 30 U.S. Environmental Protection Agency, Natural Gas STAR and Methane Connections Workshop. *Results from Recent Field and Controlled Studies of Emerging Methane Leak Detection Technologies*. Pittsburgh, PA. November 2019.
- 29 The New York State Energy Research and Development Authority (NYSERDA). *The Future of Natural Gas in a Decarbonized World – Accounting for Methane Leaks*. Albany, NY. November 2019.
- 28 Stanford Woods Institute for the Environment. *Future of Natural Gas - Keynote address for an Alumni Reception at the Edison Electric Institute*. Washington DC. October 2019.
- 27 Methane Connections Meeting, Gas Technology Institute. *New insights on methane emissions mitigation from recent field studies* (panelist). Fort Collins, CO. September 2019.



- 26 McGill University Workshop. *Re-thinking national methane emissions quantification and mitigation*. Montreal, Quebec, Canada. September 2019.
- 25 ONE Future Annual Conference. *How can we be smarter about reducing methane emissions?* Houston, TX. May 2019.
- 24 PA Senate Democratic Policy Committee Hearing. *Testimony on addressing climate change in Pennsylvania by controlling methane emissions*. Pittsburgh, PA. April 2019.
- 23 Environmental Council of States (ECOS) Spring Meeting. (*Panelist*) *Pathways for State Promotion of Innovative Methane Technologies*. Washington, DC. April 2019.
- 22 AWMA Air Quality Measurement Conference. *Methodology to Determine Equivalence for New Methane Emissions Detection Technologies*. Durham, NC. April 2019.
- 21 Distinguished Lecture Series, Harrisburg University. *Natural Gas in Pennsylvania: Energy, Innovation, and the Environment*. Harrisburg, PA. March 2019.
- 20 PA House Democratic Policy Committee Hearing. *Testimony on cost-effective policies to address methane leakage from PA's oil and gas industry*. Havertown, PA. January 2019.
- 19 Colorado State University, Path to Equivalency workshop. *The role of modeling frameworks in demonstrating technology equivalence*. Fort Collins, CO. January 2019.
- 18 INFORMS Annual Meeting. *Role of technology innovation in methane emissions mitigation policy*. Phoenix, AZ. November 2018
- 17 Methane Emissions Reduction Forum, Petroleum Technology Alliance Canada. *Technology development and deployment perspective* (panelist). Banff, AB, Canada. November 2018
- 16 Methane Connections Meeting, Gas Technology Institute. *Incorporating new technology into emissions mitigation policy*. Fort Collins, CO. November 2018.
- 15 Colorado Department of Public Health and Environment. *Stanford/EDF Mobile Monitoring Challenge: Summary results and implications for methane policy*. Webinar. November 2018.
- 14 Colorado School of Mines, Payne Institute seminar. *The role of natural gas in a carbon-constrained world*. Golden, CO. August 2018.
- 13 Colorado Department of Public Health and Environment. *How can models help inform methane emissions mitigation policy?* Denver, CO. November 2018.
- 12 California Air Resources Board, *Stanford/EDF Mobile Monitoring Challenge*. Sacramento, CA. July 2018.
- 11 The University of Texas at Austin, Energy Institute seminar. *The role of technology innovation in reducing methane emissions*. Austin, TX. July 2018.
- 10 The University of Alaska at Anchorage, Electrical Engineering seminar. *The role of natural gas in a carbon constrained world*. Anchorage, AK. March 2018.
- 9 ONE Future Coalition, Technical Committee meeting. *Good vs. good enough? Empirical tests of infrared cameras for methane leak detection*. Webinar. February 2018.
- 8 Carnegie Mellon University, Energy and Climate Decision Making Center seminar. *The role of natural gas in a carbon constrained world*. Pittsburg, PA. February 2018.
- 7 Harrisburg University of Science and Technology, Information Systems and Engineering Management seminar. *Translating science to public policy: the case of regulating methane emissions*. Harrisburg, PA. February 2018.
- 6 Las Positas College, Energy and Sustainability seminar. *The role of natural gas in a carbon constrained world*. Livermore, CA. October 2017.
- 5 San Jose State University, Department of Environmental Studies seminar. *The role of natural gas in a carbon constrained world*. San Jose, CA. October 2017.

- 4 Princeton University, Andlinger Center for Energy and Environment and Department of Electrical Engineering seminar. *Translating science to public policy: the case of regulating methane emissions*. Princeton, NJ. October 2017.
- 3 U.S. Environmental Protection Agency. *Designing better methane mitigation policies: the challenge of distributed small sources in the natural gas sector*. Webinar. April 2017.
- 2 Stanford University, Department of Energy Resources Engineering seminar. *Addressing methane emissions: technology limits to mitigation policy*. Stanford, CA. February 2017.
- 1 California Air Resources Board. *Are optical gas imaging technologies effective for methane leak detection?* Sacramento, CA. January 2017.

SELECT  
CONFERENCE  
PRESENTATIONS

Underlined names are Ph.D. students or post-doctoral scholars in my research group.

- 61 S. Roman-White, M. Harrison, D. Hammerling, **A.P. Ravikumar**, and F. George (2021). Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions at Natural Gas Production Sites. *American Geophysical Union Fall Meeting*, New Orleans LA, December 2021.
- 60 A. Strayer, and **A.P. Ravikumar** (2021). Cost-Effectiveness of Methane Mitigation Using New Technologies: A Case Study in the Denver-Julesburg Basin in Colorado. *American Geophysical Union Fall Meeting*, New Orleans LA, December 2021.
- 59 Z. Li, M. Smith, and **A.P. Ravikumar** (2021). Aerial measurements of methane emissions from midstream compressor stations in NY. *American Geophysical Union Fall Meeting*, New Orleans LA, December 2021.
- 58 S.M. Jordaan, A.W. Ruttinger, K. Surana, D. Nock, S. Miller, and A.P. Ravikumar (2021). Life Cycle Assessment of Global Gas-fired Power Plants. *American Center for Life-Cycle Assessment Fall Meeting, Virtual*, November 2021.
- 57 S. Yang, S. Hastings-Simon, and **A.P. Ravikumar** (2020). Global Liquefied Natural Gas Industry Expansion May Imperil Paris Climate Targets. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 56 A. Strayer, and **A.P. Ravikumar** (2020). Wide Variation in Life Cycle Greenhouse Gas Emissions of U.S. Natural Gas Power Plants from Upstream Methane Leakage. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 55 D. Zimmerle, C. Bell, K. Bennett, C. Kemp, and **A.P. Ravikumar** (2020). Clearing the Air: Toward a Definition of Leak Detection and Quantification Methods. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 54 **A.P. Ravikumar** (2020). Socio-Economic Constrains to India's Transition Away from Coal. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 53 J. Rutherford, E.D. Sherwin, **A.P. Ravikumar**, G. Heath, D.S. Cooley, D.R. Lyon, M. Omara, and A.R. Brandt (2020). Closing the gap: Explaining persistent underestimation of US oil and natural gas production methane inventories. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 52 C. Bell, K. Bennett, A. Duggan, S.N. Riddick, T.L. Vaughn, D. Zimmerle, D. Allen, K. Smits, and **A.P. Ravikumar** (2020). Defining a Controlled Testing Protocol for Continuous Emission Monitoring Systems Performing Leak Detection at Natural Gas Facilities. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 51 C. Kemp, and **A.P. Ravikumar** (2020). FEAST-based evaluation of methane emissions regulations – the case of state-level leak detection and repair programs. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 50 D. Singh, and **A.P. Ravikumar** (2020). Field Performance of New Methane Leak Detection Technologies at Upstream Oil and Gas Facilities. *American Geophysical Union Fall Meeting, Virtual*, December 2020.

- 49 J. Wang, and **A.P. Ravikumar** (2020). Impact of Periodic Leak Detection and Repair Programs on Methane Emissions Mitigation at Oil and Gas Facilities. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 48 K. Iskandarani, and **A.P. Ravikumar** (2020). The Fugitive Emissions Abatement Simulation Testbed- Distribution (FEAST-D): A Stochastic Model to Assess Methane Emissions Mitigation in Urban Distribution Systems. *American Geophysical Union Fall Meeting, Virtual*, December 2020.
- 47 **A.P. Ravikumar** (2020). Socio-economic Dimensions of India's Transition Away from Coal. The Institute for Operations Research and the Management Sciences (INFORMS) Annual Meeting, *virtual*, November 2020.
- 46 C. Kemp, and **A.P. Ravikumar** (2019). FEAST 3.0: Incorporating New Technologies Into Methane Mitigation Policies. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 2019.
- 45 J. Wang, B. Barlow, and **A.P. Ravikumar** (2019). Effectiveness of Leak Detection and Repair Programs in Reducing Fugitive Methane Emissions from Oil and Gas Facilities – A Large-Scale, Randomized, Field Study in Alberta, Canada. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 2019.
- 44 J. Wang, **A.P. Ravikumar**, and A.R. Brandt (2019). Techno-economic Analysis of Deep-Learning-Enabled Automated Natural Gas Leakage Detection Technologies. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 2019.
- 43 **A.P. Ravikumar**, B. Barlow, J. Wang, and D. Singh (2019). Results from the Alberta Methane Measurement Campaigns: New Insights into Oil and Gas Methane Mitigation Policy. *American Geophysical Union Fall Meeting*, San Francisco, CA, December 2019.
- 42 **A.P. Ravikumar** (2019). The role of natural gas in decarbonizing India's power sector. *International Symposium on Sustainable Systems and Technology*, Portland, OR, June 2019.
- 41 J. Wang, **A.P. Ravikumar**, S. Sreedhara, L.P. Tchammi, M. McGuire, C. Bell, D. Zimmerle, and A.R. Brandt (2018). Deep learning to classify methane leak size at oil and gas facilities. *American Geophysical Union Fall Meeting*, Washington D.C., December 2018.
- 40 T. Tran, S. Lyman, M.L. Mansfield, and **A.P. Ravikumar** (2018). Comparisons of aerial and ground based infrared leak detection camera surveys at oil and gas wells. *American Geophysical Union Fall Meeting*, Washington D.C., December 2018.
- 39 T.A. Fox, **A.P. Ravikumar**, T. Barchyn, C. Hugenholtz, M.R. Johnson, D.R. Lyon, D. Zimmerle, and T. Taylor (2018). A multi-stakeholder framework for demonstrating equivalence between regulatory and alternative leak detection and repair programs. *American Geophysical Union Fall Meeting*, Washington D.C., December 2018.
- 38 **A.P. Ravikumar**, J. Wang, J. Englander, S. Sreedhara, D. Roda-Stuart, and A.R. Brandt (2018). The role of modeling frameworks in assessing new methane leak detection protocols. *American Geophysical Union Fall Meeting*, Washington D.C., December 2018.
- 37 **A.P. Ravikumar**, and A.R. Brandt (2018). The role of technology innovation in emissions mitigation in the natural gas sector. *36<sup>th</sup> USAEE/IAEE North American Conference*, Washington D.C., September 2018.
- 36 J. Wang, **A.P. Ravikumar**, M. McGuire, C. Bell, L.P. Tchammi, and A.R. Brandt (2017). Two-stream Convolutional Neural Network for Methane Emissions Quantification. *American Geophysical Union Fall Meeting*, New Orleans, LA, December 2017.
- 35 D. J. Roda-Stuart, **A.P. Ravikumar**, and A.R. Brandt (2017). Impact of Methane Leak Detection and Repair Programs: Determining Pre- and Post-Survey Emissions Profiles. *American Geophysical Union Fall Meeting*, New Orleans, LA, December 2017.

- 34 **A. P. Ravikumar**, J. Wang, M. McGuire, C. Bell, and A.R. Brandt (2017). Of Detection Limits and Effective Mitigation: The Use of Infrared Cameras for Methane Leak Detection. *American Geophysical Union Fall Meeting*, New Orleans, LA, December 2017.
- 33 B. Nicholson, K.A. Klise, C.D. Laird, **A.P. Ravikumar**, and A.R. Brandt (2017). Optimization of Emissions Sensor Networks Incorporating Tradeoffs Between Different Sensor Technologies. *American Geophysical Union Fall Meeting*, New Orleans, LA, December 2017.
- 32 **A.P. Ravikumar**, and A.R. Brandt (2017). The role of prescriptive policies in mitigating methane emissions from the oil and gas sector. *35<sup>th</sup> USAEE/IAEE North American Conference*, Houston, TX, November 2017.
- 31 **A.P. Ravikumar**, and A.R. Brandt (2017). Distributional impacts of methane emissions on the GHG footprint of the electricity sector. *Energy Policy Research Conference*, Park City, UT, September 2017.
- 30 **A.P. Ravikumar**, J. Wang, and A.R. Brandt (2016). Is optical gas imaging effective for detecting fugitive methane emissions? A technological and policy perspective. *American Geophysical Union Fall Meeting*, San Francisco CA, December 2016.
- 29 J. Jagdeo, **A.P. Ravikumar**, E. Grubert, and A. R. Brandt (2016). A Holistic Assessment of Energy Production: Environmental, Economic, and Social Impacts of Hydraulic Fracturing in Williams County, North Dakota. *American Geophysical Union Fall Meeting*, San Francisco CA, December 2016.
- 28 Y. Kaya, **A.P. Ravikumar**, G. Chen, A. Shen, M.C. Tamargo, and C. Gmachl (2016). Absolute temperature sensing by a two-color ZnCdSe/ZnCdMgSe detector. *U.S. Workshop on the Physics and Chemistry of II-VI materials*, Baltimore MD, October 2016.
- 27 Y. Kaya, **A.P. Ravikumar**, G. Chen, M.C. Tamargo, A. Shen, and C. Gmachl (2016). Multi-leads, two-color ZnCdSe/ZnCdMgSe based quantum well infrared photodetectors. *Conference on Lasers and Electro-Optics (CLEO)*, San Jose CA, June 2016.
- 26 Y. Kaya, **A.P. Ravikumar**, G. Chen, M.C. Tarmargo, A. Shen, and C. Gmachl (2016). Multi-terminal two-color ZnCdSe/ZnCdMgSe based quantum well infrared photodetector. *American Physical Society March Meeting*, Baltimore MD, March 2016.
- 25 J. De Jesus, T.A. Garcia, **A.P. Ravikumar**, C.F. Gmachl, and M. C. Tamargo (2015). II-VI semiconductor based broadband quantum cascade detectors. *North American Conference on Molecular Beam Epitaxy (NAMBE)*, Riviera Maya, Mexico, October 2015.
- 24 J. De Jesus, T.A. Garcia, **A.P. Ravikumar**, C.F. Gmachl, and M.C. Tamargo (2015). II-VI broadband quantum cascade detectors. *17<sup>th</sup> International Conference on II-VI compounds and Related Materials (II-VI 2015)*, Paris, France, September 2015.
- 23 G. Chen, **A.P. Ravikumar**, T. Garcia, J. De Jesus, M. C. Tamargo, C. Gmachl, and A. Shen (2015). Growth and characterization of ZnCdSe/ZnCdMgSe two-color quantum well infrared photodetectors. *17<sup>th</sup> International Conference on II-VI compounds and Related Materials (II-VI 2015)*, Paris, France, September 2015.
- 22 **A.P. Ravikumar**, T.A. Garcia, J. De Jesus, M.C. Tamargo, and C. Gmachl (2015). Long wave, room temperature II-VI based quantum cascade emitters. *Conference on Lasers and Electro-Optics (CLEO)*, San Jose CA, June 2015.
- 21 O. Wolf, S. Campione, A. Benz, **A.P. Ravikumar**, S. Liu, E.A. Kadlec, E. Shaner, J.F. Klem, M.B. Sinclair, and I. Brener (2015). Coherent second harmonic generation in a quantum well – metasurface coupled system. *Conference on Lasers and Electro-Optics (CLEO)*, San Jose CA, June 2015.
- 20 O. Wolf, S. Campione, A. Benz, **A.P. Ravikumar**, S. Liu, E.A. Kadlec, E.A. Shaner, J.F. Klem, M.B. Sinclair, and I. Brener (2015). Fully customizable light sources based on second harmonic generation in a quantum well-metasurface coupled system. *Materials Research Society Spring Meeting*, San Francisco CA, April 2015.

- 19 **A.P. Ravikumar**, T.A. Garcia, J. De Jesus, M. Tamargo and C. Gmachl (2014). II-VI based broadband infrared photodetector. *US Workshop on the Physics and Chemistry of II-VI materials*, Baltimore MD, October 2014.
- 18 M. C. Tamargo, T. A. Garcia, J. De Jesus, G. Chen, V. Deligianakis, **A. P. Ravikumar**, C. Gmachl, and A. Shen (2014). Progress in wide bandgap II-VI materials for intersubband devices: quantum cascade detectors. *18<sup>th</sup> International Conference on Molecular Beam Epitaxy*, Flagstaff AZ, September 2014.
- 17 **A.P. Ravikumar**, G. Chen, T.A. Garcia, J. De Jesus, A. Shen, M. Tamargo, and C. Gmachl (2014). II-VI materials based intersubband infrared detectors. *Quantum Structured Infrared Photodetector International Conference (QSIP 2014)*, Sante Fe NM, July 2014.
- 16 **A.P. Ravikumar**, T.A. Garcia, J. De Jesus, M.C. Tamargo, and C. Gmachl (2014). High detectivity short wavelength II-VI quantum cascade detector. *Conference on Lasers and Electro-Optics (CLEO)*, San Jose CA, June 2014.
- 15 **A.P. Ravikumar**, G. Chen, J. De-Jesus, T. Garcia, M.C. Tamargo, A. Shen, and C. Gmachl (2013). High performance II-VI ZnCdSe/ZnCdMgSe based quantum cascade detectors. *12<sup>th</sup> International Conference on Intersubband Transitions in Quantum Wells (ITQW 2013)*, Bolton Landing NY, September 2013.
- 14 J. De Jesus, T.A. Garcia, S. Dhomkar, **A.P. Ravikumar**, C.F. Gmachl, A. Shen, and M. C. Tamargo (2013). Use of contactless electroreflectance and modeling techniques to characterize intersubband devices. *12<sup>th</sup> International Conference on Intersubband Transitions in Quantum Wells (ITQW 2013)*, Bolton Landing NY, September 2013.
- 13 T.A. Garcia, J. De Jesus, **A.P. Ravikumar**, S. Hong, V. Deligiannakis, C.F. Gmachl, A. Shen, and M.C. Tamargo (2013). Growth interruptions in MBE grown II-VI heterostructures for quantum cascade devices. *12<sup>th</sup> International Conference on Intersubband Transitions in Quantum Wells (ITQW 2013)*, Bolton Landing NY, September 2013.
- 12 **A.P. Ravikumar**, J. De-Jesus, T. Garcia, A. Shen, M.C. Tamargo, and C. Gmachl (2013). ZnCdSe/ZnCdMgSe based mid-infrared quantum cascade emitters. *16<sup>th</sup> International Conference on II-VI compounds and Related Materials (II-VI 2013)*, Nagahama, Japan, September 2013.
- 11 **A. P. Ravikumar**, A. Shen, G. Chen, K. Zhao, Y. Tian, P. Prucnal, M. Tamargo, and C. Gmachl (2013). High performance quantum-well infrared photodetectors made from wide band-gap II-VI semiconductors. *16<sup>th</sup> International Conference on II-VI compounds and Related Materials (II-VI 2013)*, Nagahama, Japan, September 2013.
- 10 **A.P. Ravikumar**, G. Chen, K. Zhao, Y. Tian, P. Prucnal, M. Tamargo, C.F. Gmachl, and A. Shen (2013). Room temperature and high responsivity short wavelength II-VI quantum well infrared photodetector. *Conference on Lasers and Electro-Optics (CLEO)*, San Jose CA, June 2013.
- 9 **A.P. Ravikumar**, G. Chen, K. Zhao, Y. Tian, P. Prucnal, M. Tamargo, C.F. Gmachl, and A. Shen (2013). High performance II-VI mid-wave quantum well infrared photodetector. *International Symposium on Photoelectronic Detection and Imaging (ISPD)*, Beijing, China, June 2013.
- 8 J. De Jesus, T.A. Garcia, S. Dhomkar, **A.P. Ravikumar**, C.F. Gmachl, M.C. Tamargo, and A. Shen (2013). Contactless electroreflectance characterization of a triple asymmetric coupled quantum well active region of a ZnCdMgSe-based quantum cascade laser. *American Physical Society March Meeting*, Baltimore MD, March 2013.
- 7 T.A. Garcia, J. De Jesus, **A.P. Ravikumar**, M.C. Tamargo, C.F. Gmachl, and A. Shen (2013). Material improvements of ZnCdSe/ZnCdMgSe heterostructures for quantum cascade laser applications with incorporation of growth interruptions during MBE growth. *American Physical Society March Meeting*, Baltimore MD, March 2013.

- 6 A. Shen, **A.P. Ravikumar**, A. Alfaro-Martinez, G. Chen, K. Zhao, T. Garcia, J. De Jesus, M.C. Tamargo, and C. Gmachl (2012). MBE growth of ZnCdSe/ZnCdMgSe quantum well infrared photodetectors. *North American Conference on Molecular Beam Epitaxy (NAMBE)*, Atlanta GA, October 2012.
- 5 T.A. Garcia, J. De Jesus, S. Dhomkar, R. Moug, **A.P. Ravikumar**, V. Deligiannakis, C. Gmachl, and M.Tamargo (2012). Improvements in electrical properties and crystalline quality of ZnCdSe/ZnCdMgSe heterostructures for quantum cascade laser applications. *North American Conference on Molecular Beam Epitaxy (NAMBE)*, Atlanta GA, October 2012.
- 4 J. De Jesus, T,A. Garcia, S, Dhomkar, **A.P. Ravikumar**, C. Gmachl, and M.C. Tamargo (2012). Characterization of quantum cascade laser active regions using contactless electroreflectance. *North American Conference on Molecular Beam Epitaxy (NAMBE)*, Atlanta GA, October 2012.
- 3 **A.P. Ravikumar**, Joel de Jesus, Thor Garcia, Peter Taylor, Samantha Essig, Heather Sandfort, Aidong Shen, Maria Tamargo, and Claire Gmachl (2012). II-VI short wavelength intersubband devices. *International Quantum Cascade Laser School and Workshop (IQCLSW)*, Vienna, Austria, September 2012.
- 2 **A.P. Ravikumar**, Adrian Alfaro-Martinez, Guopeng Chen, Kuaile Zhao, Maria C. Tamargo, Claire Gmachl and Aidong Shen (2012). A II-VI quantum well infrared photodetector. *Conference on Lasers and Electro-Optics (CLEO)*, San Jose CA, May 2012.
- 1 **A.P. Ravikumar**, A. Alfaro-Martinez, G. Chen, K. Zhao, M.C. Tamargo, C. Gmachl and A. Shen (2012). A II-VI quantum well infrared photodetector. *Consortium for Spectroscopic Sensor Systems (CoS3) Spring workshop*, Princeton NJ, April 2012.

TECHNICAL  
REPORTS

1. **A.P. Ravikumar**, C. Chou, J. Jhaveri, J. Baldwin, P. Hanna, K. Keller, W. Peng, S. Rabin, A. Trierweiler, T. Wang, R. Socolow (2016). **Nuclear energy from magnetic confinement fusion** *Energy Technology Distillate Series* Andlinger Center for Energy and the Environment, Princeton University.