# XIANGKUN (ELVIS) CAO

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## EDUCATION

**Cornell University** Aug. 2016 - Present
**Ph.D. Student** in Mechanical and Aerospace Engineering (current GPA: 3.97) *Ithaca, NY, USA*
Minor: Energy and Sustainability; Infection and Immunity; Entrepreneurship
Thesis Committee: David Erickson (chair), Tobias Hanrath, Saurabh Mehta
Research Interests: HI-Light for $CO_2$ Conversion, FeverPhone for Fever Diagnosis

**Nanyang Technological University** Sept. 2017
**Visiting Ph.D. Student** in School of Biological Sciences *Singapore*
Fully Funded International Summer School: Big Data Analysis for Health and Biomedical Sciences

**Tokyo Institue of Technology** Sept. 2017
**Visiting Ph.D. Student** in Education Academy of Computational Sciences *Tokyo, Japan*
Fully Funded International Summer School: Big Data Analysis for Health and Biomedical Sciences

**Massachusetts Institute of Technology** Sept. 2015 - May 2016
**Visiting Master's Student** in Nuclear Science and Engineering *Cambridge, MA, USA*
Advisors: Mujid S. Kazimi (inviter), Michael P. Short, Thomas J. McKrell
Research Interests: Accident Tolerant Fuel Cladding

**McGill University** Aug. 2014 - May 2016
**M.Eng. (Thesis)** in Mining and Materials Engineering (GPA: 3.86) *Montréal, Québec, Canada*
Thesis Committee: Roderick I.L. Guthrie (chair), Mihaiela Isac, Jun Song, George P. Demopoulos
Research Interests: Aqueous Particle Sensor for Microbubble Detection

**Xi'an Jiaotong University** Sept. 2009 - June 2013
**B.Eng.** in New Energy, **B.A.** in English Literature *Xi'an, China*
'Tsien Hsue-shen' Elite Class (Top 1%, Named after Father of Chinese Rocketry)

## EMPLOYMENT

**Graduate Research Assistant**, Cornell University, Ithaca, NY, USA Dec. 2016 - Present
Integrated Micro & Nano Fluidic Systems Laboratory (Erickson Lab)

**Graduate Teaching Assistant**, Cornell University, Ithaca, NY, USA Aug. 2017 - Dec. 2017
MAE 2210: Thermodynamics (Instructor: Elizabeth M. Fisher)

**Visiting Graduate Research Assistant**, MIT, Cambridge, MA, USA Sept. 2015 - May 2016
Mesoscale Nuclear Materials Laboratory (Short Lab)

**Graduate Teaching Assistant**, McGill University, Montréal, Québec, Canada Feb. 2015 - May 2015
MIME 455: Advanced Process Engineering (Instructor: Frank Mucciardi)

**Graduate Research Assistant**, McGill University, Montréal, Québec, Canada Aug. 2014 - Sept. 2015
McGill Metals Processing Centre (Guthrie Lab)

**Research Assistant**, Xi'an Jiaotong University, Xi'an, China Sept. 2012 - June 2014
Ministry of Education Key Laboratory of Thermal Fluid Science and Engineering (Yaling He's Lab)

**Industrial Trainee**, Guodian United Power Technology Co., Ltd, Hebei, China July 2012 - Aug. 2012
Wind Turbine Manufacturing Division (Baoding Branch)

**Undergraduate Research Assistant**, Xi'an Jiaotong University, Xi'an, China Sept. 2011 - June 2012
State Key Laboratory of Multiphase Flow in Power Engineering (Bofeng Bai's Lab)

## MAJOR AWARDS AT CORNELL

- Nominee for U.S. Forbes 30 Under 30 in Energy 2019, Forbes Magazine (ongoing) 2018
- International Finalist (10 in the world), **$20M NRG COSIA Carbon XPRIZE** (ongoing) 2018
- **$750 First Place Award**, 2018 TCAM Poster/Pitch Competition, Atkinson Center 2018
- Local Pathways Fellowship (LPF), UN SDSN – Youth Initiative (SDSN Youth) 2018
- Selectee, NSF I-Corps Node - Binghamton & Cornell (Clean Energy) 2018
- Forbes Under 30 Scholar, Forbes Magazine 2018
- National Finalist, Young Champions of the Earth in China, UN Environment 2018
- Third Place Award, "Our Microbes, Our Global Health" Symposium Poster Contest 2018
- National Third Place Prize Winner, "Science in a minute" Video Contest, AAAS 2018
- Awardee, the inaugural **$20K "Scale-Up and Prototyping"** Award, Cornell University 2017
- Cornell Graduate Student Conference Grant (SPIE'17) 2017
- **$20K Grand Prize (1/1,150)**, "Create the Future" Design Contest, NASA Tech Briefs 2017
- Best Poster Award, ACLS International Summer School, Tokyo Tech & NTU 2017
- First Place in Student Research Presentation, 9th Annual NYS Biotech Symposium 2017
- National Graduate Division Winner, Sigma Xi Student Research Showcase, Sigma Xi 2017
- Excellence in Research, Journey through Science, the New York Academy of Sciences 2017
- People's Choice Award, Three Minute Thesis (3MT) Competition, Cornell University 2017

## EXPERIENCE

**HI-Light: A Solar Thermal Reactor for $CO_2$ Reduction** Dec. 2016 - Present
*Project Lead* (joint work with Y. Kaminer, J. Silva, Cornell) *Ithaca, NY*

- Constructed chemical reactors of 0.1L, 0.3L, and 1L, for solar thermal conversion of $CO_2$ to fuels.
- Received **$20K International Grand Prize** from NASA Tech Briefs "Create the Future" Design Contest, and **$20K "Scale-up and Prototyping Award"** from Cornell Engineering.
- Presented research at the **SPIE'18** conference, submitted research to the **ACS'19** conference.
- Entered the final of the **$20M NRG COSIA Carbon XPRIZE (10 in the world)**.

**FeverPhone for Acute Febrile Illness Diagnosis using a Mobile Device** Dec. 2016 - Present
*Thesis Research* (joint work with J. Kim, Cornell) *Ithaca, NY*

- Developed a latex bead nanoparticle-based two-color Malaria-Typhoid dual detection LFIA.
- Conducted extensive clinical sample testing for the validation study.
- Presented research at the **SPIE'18** conference. Received **First Place Award** at **TCAM'18** by Atkinson Center, **Best Poster Award twice**, etc. Wrote two papers as the first/co-first author.

**Point of Care Inflammation Assessment with a Mobile Device** Dec. 2016 - Present
*Thesis Research* (joint work with Y. Serge, Cornell) *Ithaca, NY*

- Developed a Europium nanoparticle-based LFIA for co-detection of C-Reactive Protein (CRP) and Procalcitonin (PCT) antigens in human serum.

- Performed validation study and demonstrated good correspondence with gold standard approaches.
- Wrote one paper as the co-first author.

**Multi-metallic Layered Composite Accident Tolerant Fuel Cladding** Sept. 2015 - May 2016
*Research Assistant* (joint work with S. McAlpine, MIT) *Cambridge, MA, USA*

- Performed thermochemical analysis to identify promising metal candidates for the multi-metallic layered structure with FactSage.
- Contributed to the building of the oxidation experimental set-up.

**A Particle Sensor for Optimizing Inclusion Removal by Bubbles** Aug. 2014 - Sept. 2015
*Project Lead (*joint work with S. Chang, McGill*)* *Montréal, Québec, Canada*

- Designed an aqueous particle sensor system for in-situ and on-line measurement for microbubble.
- Optimized gas bubbling from ladle shroud for inclusion removal in water modeling tundish.
- Published **four refereed journal papers** including ISIJ Int., METALL MATER TRANS B.

**A Swirl Generator in High Water-cut Crude Oil Cold Transmission** Sept. 2011 - June 2012
*Undergraduate Research Assistant (*joint work with C. Wang, R. Han, Z. Yan, R. Liu, M. Hu, Xi'an Jiaotong University*)* *Xi'an, China*

- Designed a structure optimized swirl generator, based on numerical simulations with FLUENT.
- Constructed an experimental set-up to test the performance of the swirl generator for water-oil separation, with different oils.
- Project received **Outstanding Award (Top 4/2049)** in the National University Student Social Practice and Science Contest on Energy Saving & Emission Reduction, by Ministry of Education of China.

## PUBLICATIONS

1. **Cao, X.**, Silva J., Kaminer Y., Hanrath T., Erickson D., "HI-Light: A Solar Thermal Chemical Reactor for CO2 Reduction." In Preparation (2018)
2. **Cao, X.**, Hanrath T., Erickson D., "Overview and Outlook on CO2 Conversion by Light Alkanes." In Preparation (2018)
3. **Cao, X.**, Lu Z., Wang R., Ren Y., Mehta S., Erickson D., "Two-Color Multiplexed Lateral Flow Immunoassay for Point-of-Care Differential Detection of Malaria and Typhoid." In Preparation (2018)
4. **Cao X.**, Kim J., Mehta S., Erickson D., "Quantitative Two-Color Multiplexed Lateral Flow Immunoassay for Detecting Malaria." In Preparation (2018)
5. Serge Y.*, **Cao X.***, Wang R., Lu Z., Ren Y., Mehta S., Erickson D., "A Lateral Flow Immunochromatographic Assay for Point-Of-Care Detection of C-Reactive Protein (CRP) and Procalcitonin (PCT) Antigens in Human Serum." In Preparation (2018) * indicates equal contribution.
6. Wang R., Serge Y., Lu Z., Tablante E., Colt S., **Cao, X.**, Ren Y., Cárdenas W., Mehta S., Erickson D., "A Rapid Diagnostic Platform for Colorimetric Differential Detection of Dengue and Chikungunya Viral Infections." Under Review (2018)
7. Zhou Z., Liu X., Xu J., **Cao, X.**, Zhu X., "Elemental Mercury Removal over a Novel Starch Modified MnOx/bentonite Composites." Under Review (2018)
8. Zhou Z., Cao T., Liu X., Xu S., **Cao, X.**, Xu Z., Xu M., "Vanadium Silicate (EVS)-supported Silver Nanoparticles: A Novel Catalytic Sorbent for Elemental Mercury Removal from Flue Gas." Under Review (2018)

9. Zhou Z., Xu X., **Cao, X.**, Xu J., Liao Z., Xu M., "Deeper Insight into the Inhibitory Effect of $H_2O$ on Elemental Mercury Removal over MnOx based Catalyst from Coal-fired Flue Gas." Under Review (2018)
10. Liu X.*, **Cao, X.***, Liu Y., Li X., Wang M., Li M., "Branched Multiphase $TiO_2$ with Enhanced Photoelectrochemical Water Splitting Activity." International Journal of Hydrogen Energy 43 (46), 21365-21373 (2018) * indicates equal contribution.
11. Zhou Z., Liu X., Hu Y., Xu J., **Cao, X.**, Liao Z., Xu M., "Investigation on Synergistic Oxidation Behavior of NO and Hgo during the Newly Designed Fast SCR Process." Fuel 225, 134-139 (2018)
12. Chang S., **Cao, X.**, Zou Z., "Regimes of Micro-bubble Formation Using Gas Injection into Ladle Shroud." Metallurgical and Materials Transactions B 49 (3), 953-957 (2018)
13. Chang S., **Cao, X.**, Zou Z., Isac M., Guthrie R., "Micro-bubble Formation under Non-wetting Conditions in a Full-scale Water Model of a Ladle Shroud/Tundish System." ISIJ International 58 (1), 60-67 (2018)
14. Chang S., **Cao, X.**, Hsin C., Zou Z., Isac M, Guthrie R., "Removal of Inclusions using Micro-bubble Swarms in a Four-strand, Full-scale, Water Model Tundish." ISIJ International 56 (7), 1188-1197 (2016)
15. Chang S., **Cao, X.**, Zou Z., Isac M, Guthrie R., "Micro-Bubble Swarms in a Full Scale Water Model Tundish." Metallurgical and Materials Transactions B 47 (5), 2732–2743 (2016)

## JOURNAL/CONFERENCE REVIEWED

- *Metallurgical and Materials Transactions B* (2018-Present)

## TALKS & PROFESSIONAL ACTIVITIES

1. "Beyond Thermal Equilibrium: A HI-Light Reactor for Reverse Water-Gas Shift Reaction", Spring 2019 ACS National Meeting (ACS'19), Mar. 31 - Apr. 4, 2019, Orlando, FL, USA. (Submitted)
2. "Overview and Outlook on $CO_2$ Photothermal Conversion by Light Alkanes", Spring 2019 ACS National Meeting (ACS'19), Mar. 31 - Apr. 4, 2019, Orlando, FL, USA. (Submitted)
3. "High-performance $TiO_2$ Nanostructured Array Photoanode for Hydrogen Production from Water Splitting", Spring 2019 ACS National Meeting (ACS'19), Mar. 31 - Apr. 4, 2019, Orlando, FL, USA. (Submitted)
4. "FeverPhone: Fever Diagnosis on Your Phone", Cornell Symposium on Public Health, Nov. 2018, Ithaca, NY, USA. (Scheduled)
5. "FeverPhone: Fever Diagnosis on Your Phone", Ninth Annual 50-Second Sustainability Project Pitch and Poster Competition (TCAM'18), Nov. 2018, Ithaca, NY, USA. **(First Place Award)**
6. "Fever Diagnosis on a Mobile Device", Oral Presentation at the 2018 Sibley Graduate Research Symposium (SGRS'18), Oct. 2018, Ithaca, NY, USA. **(Shows Most Promise in "Drafting the Future")**
7. "FeverPhone", Poster 4, Poster Presentation at the "Our Microbes, Our Global Health" Symposium, Aug. 2018, Ithaca, NY, USA. **(International Third Place Winner)**

8. “HI-Light Technology: A Solar-thermocatalytic Reactor for $CO_2$ Reduction”, Poster 1, Poster Presentation at the Carbon Dioxide Removal/New Carbon Economy Consortium workshop, May 2018, Ithaca, NY, USA.
9. “FeverPhone”, Video Presentation at the 2018 Emerging Researchers National (ERN) Conference in STEM, Feb. 2018, Washington, DC, USA. **(National Third Place Winner)**
10. “HI-Light: An Optofluidic Reverse Combustion Reactor for Photothermo-catalytic Conversion of $CO_2$ into Fuels”, Paper 10491-36, Oral Presentation at the 2018 Photonics West and BiOS Conferences (SPIE BIOS’18), Jan. 2018, San Francisco, CA, USA.
11. “A Smartphone Based Dual-plexed Molecular Diagnostics Platform for Point-of-care (POC) Inflammation Assessment”, Paper 10485-28, Oral Presentation at the 2018 Photonics West and BiOS Conferences (SPIE BIOS’18), Jan. 2018, San Francisco, CA, USA.
12. “FeverPhone: Fever Diagnosis on Your Phone", Invited Talk as Featured Graduate Speaker, at Sigma Xi Student Research Conference, Nov. 2017, Raleigh, NC, USA.
13. “FeverPhone: An Expandable Diagnostic Platform", Invited Talk at the 2nd Annual SPARK Talks of Cornell University (SPARK’17), Oct. 2017, Ithaca, NY, USA.
14. “Application of Smartphone Technology in Food Safety", Invited Talk at Journey Through Science Day at the New York Academy of Sciences, Oct. 2017, New York City, NY, USA.
15. “FeverPhone”, Poster 12, Poster Presentation at the Cornell NanoScale Facility 2017 Annual Meeting (CNF’17), Sept. 2017, Ithaca, NY, USA.
16. “FeverPhone: Point of Care Diagnosis of Acute Febrile Illness using a Mobile Device”, Poster 23, Poster Presentation at the ACLS International Summer School (ACLS’17), Sept. 2017, Singapore. **(Best Poster Award)**
17. “The Commercial Opportunities in Carbon Conversion”, Business Pitch at the 2017 MIT-CHIEF China Trip in Zhongguancun Software Park Development Co, Ltd., July. 2017, Beijing, China. **(Best Pitch Award)**
18. “Facile Preparation of Nano-branched $TiO_2$ Thin Films for Photoelectrochemical Hydrogen Generation”, Poster 48, Poster Presentation at the 3rd International Symposium on Energy Conversion and Storage (ISECS’17), June 2017, Nanjing, China.
19. “A Multiscale 3D Simulation of an Optofluidic Reverse Combustion Reactor for Photocatalytic Conversion of $CO_2$ into Hydrocarbons”, Poster 65, Poster Presentation at the 3rd International Symposium on Energy Conversion and Storage (ISECS’17), June 2017, Nanjing, China.
20. “FeverPhone: Fever Diagnosis with a Mobile Device”, Poster 6, Poster Presentation at the 9th Annual New York State Biotechnology Symposium (NYSBS’17), May 2017, Syracuse, NY, USA. **(Best Poster Award)**
21. “FeverPhone", Invited Talk at Ithaca’s March for Science Event, Apr. 2017, Ithaca, NY, USA.
22. “FeverPhone: Fever Diagnosis on Your Phone", Sigma Xi’s 5th Annual Student Research Showcase, Apr. 2017, North Carolina, USA. **(National Graduate Division Winner)**
23. “FeverPhone", Contest Talk at Cornell’s 3rd Three Minute Thesis (3MT) Competition, Mar. 2017, Ithaca, NY, USA. **(People’s Choice Award)**
24. “An Aqueous Particle Sensor (APS) for Monitoring Inclusion Removal by Microbubbles in Tundish Operations”, Paper 963, Oral Presentation at the XXVIII International Mineral Processing Congress (IMPC’16), Sept. 2016, Québec City, Québec, Canada.

25. "From Iron Man to Micro Bubbles", Contest Talk at McGill's 4th Three Minute Thesis (3MT) Competition, Apr. 2015, Montréal, Québec, Canada. **(Finalist)**
26. "Optimization of Inclusion Removal by Micro-bubbles with an Aqueous Particle Sensor", Poster Presentation at McGill University, Dec. 2014, Montréal, Québec, Canada.

## TEACHING

**Teaching Assistant** Aug. 2017 - Dec. 2017
*Cornell University, Instructor: Elizabeth M. Fisher* *Ithaca, NY, USA*

- MAE 2210: Thermodynamics

**Teaching Assistant** Feb. 2015 - May 2015
*McGill University, Instructor: Frank Mucciardi* *Montréal, Québec, Canada*

- MIME 455: Advanced Process Engineering

## COURSE HIGHLIGHTS

- NCC 5530 Marketing Management, Spring 2019, Cornell
- NCC 5560 Managerial Finance, Spring 2019, Cornell
- NBA 5070 Entrepreneurship for Scientists and Engineers, Fall 2018, Cornell
- MSE 5330 Materials for Energy Production, Storage, and Conversion, Fall 2018, Cornell
- MAE 6620 Biomed Tech Point of Care Diag, Spring 2017, Cornell
- MAE 6510 Advanced Heat Transfer, Fall 2016, Cornell
- MAE 5430 Combustion Processes, Fall 2016, Cornell
- CHEE 631 Foundations of Fluid Mechanics, Fall 2014, McGill
- MIME 653 Transport Phenom-Process Metal, Fall 2014, McGill

## MENTORED PROJECTS

1. Cheng-Hung (Jason) Hsin. "Water modeling experiments and real-time particle detection sensors". Undergraduate Co-op Research Project, Spring 2015 (The Co-op in Materials Engineering Program, McGill University, Montréal, Québec, Canada)
2. Sarkar Nathan. "A Capillary Paper Biofluid Viscometer". Undergraduate Honors Thesis Project, Spring 2018 (The Biological Sciences Honors Program, Cornell University, Ithaca, NY, USA)

## LEADERSHIP

**Vice President** Aug. 2018 - Present
*Chinese Entrepreneur Association at Cornell (CEAC)* *Ithaca, NY, USA*

- Organized orientation events for new Chinese Ph.D. students at Cornell.
- Organized entrepreneur talks and networking activities.

**Vice President and Treasurer** Sept. 2017 - Present
*Cornell Chinese Visiting Scholars/Students Association (CVSA)* *Ithaca, NY, USA*

- Coordinated events for over 500 Chinese visiting students, professors, and postdocs at Cornell.
- Organized campus workshops and networking activities.

**Web Manager and Book Editor** Apr. 2016 - Present
*Xi'an Jiaotong University Online Overseas Education Forum (XJTU BBS GoAbroad Forum)* *Xi'an, China*

- Organized graduate school application online Q&A events for over 6,000 students in Xi'an Jiaotong University.
- Edited a 120-page graduate school application guide "My story of going abroad" consisting of 25 stories of XJTUers from 10 majors.

**Class Representative, Youth League Secretary, and Party Secretary** Sept. 2009 - June 2012
*Xi'an Jiaotong University 'Tsien Hsue-shen' Honors College* *Xi'an, China*

- Organized team bonding activities aiming for increasing interactions between classmates and job talks facilitating career development for students.
- Received "Outstanding Student Leader" award twice.

## PROFESSIONAL MEMBERSHIP

- The International Society for Optics and Photonics (SPIE), 2018 - Present
- American Physical Society (APS), 2017 - Present
- The New York Academy of Sciences (NYAS), 2017 - Present
- Sigma-Xi, the Scientific Research Honor Society, 2017 - Present
- American Society for Gravitational and Space Research (ASGSR), 2017 - Present
- Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2014 - Present

## TECHNICAL STRENGTHS

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|---|---|
| **Programming Languages** | Python, C++, LabVIEW, DASYLab |
| **Experimental skills** | LFIA development, Microfludics, Materials characterization |

## MISCELLANEOUS

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|---|---|
| **Languages** | Proficient in Mandarin and English |
| **Hobbies** | Reading, Singing, Photography |
| **Fun facts** | I can swing books with each of the five fingers of my right hand! |

Last updated: November 8, 2018