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Jet Propulsion Laboratory, California Institute of Technology
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EDUCATION

California Institute of Technology, Pasadena, CA, USA

Ph.D. in Chemistry (chemical physics)

June, 1999

Dissertation: "Terahertz Generation via Optical-Heterodyne Conversion: Development of a New Far-Infrared Spectrometer and Its Applications toward a Better Understanding of Nonrigid, Astronomically Important Molecules."

University of California, Berkeley, CA, USA

B.S. in Chemistry

December, 1991

SELECTED AWARDS & HONORS

- NASA Certificate of Appreciation in recognition of "valuable contribution and outstanding support to the Advanced Component Technologies (ACT) program and the NASA Earth Science Technology Office." **2009**
- JPL Team Bonus Award for the "successful balloon flight of the Planetscope Precursor Experiment." **2008**
- NASA Group Achievement Award for the "Molecular Spectroscopy Team." **2006**
- NASA Group Achievement Award for the "Aura Microwave Limb Sounder Instrument Team." **2005**
- NASA Group Achievement Award for the "Balloon Observations of the Stratosphere Team." **2004**
- NASA New Investigator in Earth Science (funding award). **2002 – 2005**
- National Research Council's Postdoctoral Research Associateship. **1999 – 2000**
- NASA New Technology Report Award for "Tunable Terahertz Source Using Near Infrared Diode Lasers." **1999**

EXPERIENCE

California Institute of Technology, Pasadena, CA, USA

Visiting Associate

2007 – Present

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

Research Scientist/Scientist IV

2006 – Present

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

Group Supervisor (acting, Atmospheric Laser Spectroscopy Group)

12/2006 – 2/2007

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

Scientist

2000 – 2006

National Institute of Standards & Technology (NIST), Boulder, CA, USA

Research Chemist (post-doctoral)

1999 – 2000

California Institute of Technology, Pasadena, CA, USA

Graduate Research Assistant	1992 – 1999
<i>Air Instruments & Measurements, LLC, Baldwin Park, CA, USA</i>	
Consultant	1997 – 1998
<i>Lawrence Berkeley Laboratory, Berkeley, CA, USA</i>	
Undergraduate Research Assistant, Research Associate (approximate title)	1990 – 1992, 1988 – 1989

PI FUNDING AWARDS

<i>JPL Research & Technology Development Program (R&TD)</i>	\$400K
"Chemistry & Transport Modeling of Exoplanetary Atmospheres"	2010 – 2011
<i>NASA Planetary Instrument Definition & Development Program (PIDDP)</i>	\$1,077.7K
"Massively Parallel, Cavity-Enhanced, Laser Spectroscopy (MCELS) for Planetary and Lunar Exploration"	2009 – 2013
<i>JPL Center for Exoplanet Science</i>	\$7.3K
"Seeing in the Stratosphere"	2009
<i>NASA Mars Fundamental Research Program (MFRP)</i>	\$255.3K
"Kinetic-Isotope Effects of Key Photochemical Reactions on Mars"	2007 – 2010
<i>NASA Planetary Instrument Definition & Development Program (PIDDP)</i>	\$636.8K
"A New <i>In-Situ</i> Measurement Technique for Stable-Isotope Analysis of Methane and Other Important Atmospheric/Volatile Species on Mars"	2005 – 2008
<i>JPL Innovative Spontaneous Concepts (ISC)</i>	\$30K
"Proof of a Novel Concept for Measuring Optical Properties of Aerosols"	2006
<i>JPL Research & Technology Development Program (R&TD)</i>	\$343K
"A Promising New Near-Infrared Laser Technique for <i>In-Situ</i> Mars Exploration"	2003 – 2005
<i>NASA New Investigator Program in Earth Science (NIP)</i>	\$346.4K
"Tropospheric Monitoring of CO Isotopes by Cavity-Enhanced, Optical Heterodyne Spectroscopy"	2002 – 2005

CO-I FUNDING AWARDS

<i>NASA Experimental Program to Stimulate Competitive Research (EPSCoR)</i>	
"New Mexico Exoplanet Spectroscopic Survey Instrument (NESSI)," PI: Dr. Patricia Hynes	2009 – 2012
<i>NASA Planetary Instrument Definition & Development Program (PIDDP)</i>	
"Aquarius: An <i>In Situ</i> Water Isotope Analyzer for Exploring Planetary Ice," PI: Dr. Miles Smith	2008 – 2011
<i>JPL Research & Technology Development Program (R&TD)</i>	
"Advanced InGaAs-based Single-Mode Semiconductor Lasers for Atmospheric Sensing and Lidar," PI: DR. Yueming Qiu	2002 – 2005
<i>JPL Bio-Nano Technology Program</i>	
"Quantum Dot Lasers for NASA <i>In-Situ</i> Sensing Applications," Dr. Yueming Qiu	2002 – 2005

INVITED LECTURES/SEMINARS

Planetary Evolution & Habitability course, California Institute of Technology, Pasadena, CA, USA

"Extrasolar Planets: Life, Habitability, Climate, & Atmosphere" March, 2011

Workshop on Innovative Approaches to Exoplanet Spectra, Keck Institute for Space Studies, California Institute of Technology, CA, USA

"Balloon Environment" November, 2009

Planetary Evolution & Habitability course, California Institute of Technology, Pasadena, CA, USA

"Atmospheric Laser Spectroscopy for *In-Situ* Habitability Detection" March, 2009

The Center for Adaptive Optics Fall 2007 Retreat, Lake Arrowhead, CA, USA

"Stratospheric seeing & contrast limits for a balloon-borne coronagraph" November, 2007

Yuk Yung Lunch Seminar Series, California Institute of Technology, CA, USA

"Noise-immune, cavity-enhanced spectroscopy and ultra-sensitive atmospheric measurements" February, 2006

"Enlightenment Lecture", Nippon Institute of Technology, Japan

"Optoelectronic terahertz sources based on photomixers" February, 2003

TEACHING/MENTORING EXPERIENCE (some redundancy with "Invited Lectures/Seminars")

California Institute of Technology, Pasadena, CA, USA

Invited Lecturer

Presented lecture on "Extrasolar Planets: Life, Habitability, Climate, & Atmosphere" to the "Planetary Evolution & Habitability" class in the Geological & Planetary Sciences Division 2011

California Institute of Technology, Pasadena, CA, USA

Invited Lecturer 2009

Presented lecture on "Atmospheric Laser Spectroscopy for In-Situ Habitability Detection" to the "Planetary Evolution & Habitability" class in the Geological & Planetary Sciences Division.

California Institute of Technology, Pasadena, CA, USA

Graduate-Student Mentor/Ph.D. Thesis Committee Member 2003 – present

Mentoring chemistry graduate students conducting research in spectroscopic instrumentation.

Jet Propulsion Laboratory, California Institute of Technology, CA, USA

Undergraduate-Student Mentor 2007 – present

Mentoring summer undergraduate students conducting research in spectroscopic instrumentation.

Nippon Institute of Technology, Saitama Prefecture, Japan

Invited Lecturer 2003

Presented four lectures to graduate students in the Department of Electrical and Electronics Engineering on advanced theories and techniques in the areas of collisional broadening of molecular lines, quantitative spectroscopic measurements, and terahertz technology. Directly advised graduate students on experimental design and data analysis techniques. Presented an "enlightenment lecture" to department faculty and general audience.

California Institute of Technology, Pasadena, CA, USA

Teaching Assistant – "Fundamental Techniques of Experimental Chemistry." 1993

Instructed and supervised students in introductory undergraduate laboratory chemistry course.

Teaching Assistant – “Chemical Equilibrium and Analysis Laboratory.” **1993**
 Instructed and supervised students in conducting experiments designed to illustrate modern instrumental techniques that are currently employed in industrial and academic research. Emphasis was on determinations of chemical composition, measurement of equilibrium constants, evaluation of rates of chemical reactions, and trace-metal analysis.

PROFESSIONAL SERVICE

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Co-organizer, “UCLA-JPL Planets/Exoplanets Day” workshop **2011**

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Member, hiring committee, staff scientist position in earth atmospheric science **2010**

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Co-author, white paper on “Laboratory Spectroscopy to Support Remote Sensing of Atmospheric Composition,” submitted to the National Academies Space Studies Board’s Planetary Science Decadal Survey. **2009**

Keck Institute for Space Studies, California Institute of Technology, Pasadena, CA, USA
Core member of study program: “Innovative Approaches to Exoplanet Spectra.” **2009**

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Co-author, “Planetscope: Exoplanet Characterization from a Balloon Platform,” in response to the request for information from Astro2010: Astronomy and Astrophysics Decadal Survey Subcommittee on Programs. **2009**

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Co-signer, white paper on “Exoplanet Characterization and the Search for Life,” submitted to *Astro2010: the Astronomy and Astrophysics Decadal Survey*. **2009**

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Member, Technical Excellence Committee **2008 - Present**

Small Business Innovation Research Program (SBIR)
Proposal Peer Reviewer **2000 – Present**

Applied Optics, Applied Physics B, Chemical Physics Letters, Journal of Molecular Spectroscopy, Science
Peer Reviewer **1999 – Present**

NASA Advanced Component Technology Program
Proposal Peer Reviewer **2008**

Earth System Scholars Network (ESSN)
Member, Mission Statement Committee **2004**

National Urban League Conference, Los Angeles, CA, USA
Volunteer, Career Fair for JPL **July, 2002**

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
Organizer, “Atmospheric Chemistry, Dynamics & Radiation Seminar Series” **2001 – 2002**

PEER-REVIEWED PUBLICATIONS

- Swain, MR; Deroo, P; Griffith, CA; Tinetti, G; Thatte, A, Vasisht, G; Chen, P; Bouwman, J; Crossfield, IJ; Angerhausen, D; Afonso, C; Henning, T. "A ground-based near-infrared emission spectrum of the exoplanet HD189733b," *Nature*, **463**, doi: 10.1038, 2010.
- Swain, MR; Tinetti, G; Vasisht, G; Deroo, P; Griffith, C; Bouwman, J; Chen, Pin; Yung, Y; Burrows, A. Brown, LR; Matthews, J; Rowe, JF; Kuschig, R; Angerhausen, D. "Water, methane, and carbon dioxide present in the dayside spectrum of the exoplanet HD 209458b," *Astrophys. J.*, **704**: 1616-1621, 2009.
- Swain, MR; Vasisht, G; Tinetti, G; Bouwman, J; Chen, Pin; Yung, Y; Deming, D; Deroo, P. "Molecular Signatures in the Near Infrared Dayside Spectrum of HD 189733b," *Astrophys. J. Lett.*, **690**: L114-L117, 2009.
- Traub, WA; Chen, P; Kern B.; Matsuo, T. "Planetscope: An Exoplanet Coronagraph on a Balloon Platform." *Proceedings of the SPIE – The International Society for Optical Engineering*, **7010**(70103S), DOI:10.1117/12.788087, 2008.
- Trudeau, ME; Chen, P; de Andrade Garcia, G., Hollberg, LW; Tans, PP. "Stable isotopic analysis of atmospheric methane by infrared spectroscopy using diode laser difference-frequency generation," *Appl. Optics*, **45**(17): 4136-4141, 2006.
- Chen, P; Pearson, JC; Pickett, HM; Matsuura, S; Blake, GA. "Measurements of $^{14}\text{NH}_3$ in the $v_2 = 1$ state by a solid-state, photomixing, THz spectrometer and a simultaneous analysis of the microwave, terahertz, and infrared transitions between the ground and v_2 inversion-rotation levels," *J. Mol. Spectrosc.*, **236**(1): 116-126, 2006.
- Kleiner, I; Tarrago, G; Cottaz, C; Sagui, L; Brown, LR; Poynter, RL; Pickett, HM; Chen, P; Pearson, JC; Sams, RL; Blake, GA; Matsuura, S; Nemtchinov, V; Varanasi, P; Fusina, L; Di Lonardo, G. " NH_3 and PH_3 line parameters: the 2000 HITRAN update and new results." *J. Quant. Spectrosc. Radiat. Transf.*, **82**(1-4): 293-312, 2003.
- Pearson, J.C.; Chen, P.; Pickett, H.M. "Photomixer systems as submillimeter oscillators and coherent test sources." *Proceedings of SPIE - The International Society for Optical Engineering*, **4855**: 459-467, 2003.
- Chen, P; Pearson, JC; Pickett, HM; Matsuura, S; Blake, GA. "Submillimeter-wave measurements and analysis of the ground and $v_2 = 1$ states of water," *Astrophys. J. Suppl. Ser.*, **128**(1): 371-385, 2000.
- Matsuura, S; Chen, P; Blake, GA; Pearson, JC; Pickett, HM. "A tunable cavity-locked diode laser source for terahertz photomixing," *IEEE Trans. Microw. Theory Tech.*, **48**(3): 380-387, 2000.
- Chen, P; Pearson, JC; Pickett, HM; Matsuura, S; Blake, GA. "A Three-Diode-Laser, Terahertz-Difference-Frequency Synthesizer and Its Applications toward Far-Infrared Spectroscopy of Ammonia and Water," in L. Hollberg and R. J. Lang (Eds.), *Trends in Optics and Photonics: Advanced Semiconductor Lasers and Their Applications vol. 31*, pp. 103-105, Washington, D.C., Optical Society of America, Washington, DC, 2000.
- Matsuura, Shuji; Chen, Pin; Blake, Geoffrey A.; Pearson, J.C.; Pickett, H. M. "Two-frequency MOPA diode laser system for difference frequency generation of coherent THz-waves." *Proceedings of SPIE - The International Society for Optical Engineering*, **3617**: 14-21, 1999.
- Matsuura, S; Chen, P; Blake, GA; Pearson, JC; Pickett, HM. "Simultaneous amplification of terahertz difference frequencies by an injection-seeded semiconductor laser amplifier at 850 nm," *Int. J. Infrared Millimeter Waves*, **19**(6): 849-858, 1998.
- Chen, P; Blake, GA; Gaidis, MC; Brown, ER; McIntosh, KA; Chou, SY; Nathan, MI; Williamson, F. "Spectroscopic applications and frequency locking of THz photomixing with distributed-Bragg-reflector diode lasers in low-temperature-grown GaAs," *Appl. Phys. Lett.*, **71**(12): 1601-1603, 1997.
- Young, AT; Chen, P; Leung, KN; Pan, L; Ponce, D; Stutzin, GC. "Laser and spectroscopic diagnostics of H^+ ion-source plasmas," *Rev. Sci. Instrum.*, **65**(4): 1416-1418 Part 2, 1994.
- Young, AT; Stutzin, GC; Chen, P; Kunkel, WB; Leung, KN. "Measurement of Atomic and Molecular-hydrogen in a tandem magnetic multicusp H^+ ion-source by VUV spectroscopy," *Rev. Sci. Instrum.*,

CONFERENCE PAPERS (INCOMPLETE LIST)

- Sung, K., Chen, P., Crawford, T.J., "A new approach proposed to Fourier transform spectroscopy using a broad-band laser source," *2010 AGU Fall Meeting*, San Francisco, CA, U.S.A., December 2010.
- Line, M.R., Chen, P., Yung Y.L., "The Impact of UV Irradiance on the Composition of Exoplanets," *42nd annual meeting of the Division for Planetary Sciences of the American Astronomical Society*, Pasadena, CA, U.S.A., October, 2010
- Sung, K., Chen, P., Crawford, T.J., "High Resolution Fourier Transform Spectroscopy in the 1.57 μm Region Using a Frequency Comb Laser Source," *The 11th HITRAN Database Conference*, Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts, U.S.A., June 2010.
- Chen, P., Traub, W.A., Kern, B.D., Matsuo, T., "Seeing in the stratosphere," *AAS Bulletin*, **41**(1), 213th AAS Meeting, Abstract 475.18, January 2009.
- Swain, M.R., Chen, P., Vasisht, G., "The balloon-borne exoplanet spectroscopy telescope," *AAS Bulletin*, **41**(1), 213th AAS Meeting, Abstract 475.20, January 2009.
- Chen, P., Gordon, B., Kern, B., Nemati, B., Shao, M., Traub W., Trauger J., "Stratospheric seeing and contrast limits for a balloon-borne coronagraph," *Exoplanet Science & Technology Fair*, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, U.S.A., February 2008.
- Chen, P., Traub W., Shao, M., Trauger, J., Kern, B., Nemati, B., Netterfield, B., Kasdin, J., "A balloon-borne, planet-characterizing telescope concept," *Navigator Program Forum 2007*, NASA Ames Research Center, CA, U.S.A., May 2007.
- Chen, P., Robichaud, D. J., Yeung L., Okumura M., Yung Y. L., "Noise-immune, cavity-enhanced spectroscopy and ultra-sensitive atmospheric in-situ measurements," *Asia Oceania Geosciences Society 3rd Annual Meeting*, Singapore, Jul. 2006.
- Chen P., Robichaud D. J., Okumura M., and Yung Y. L., "A cavity-enhanced, optical-heterodyne spectrometer and its relevance to future Titan exploration," *Astrobiology Science Conference (AbSciCon) 2006*, Washington, D.C., U.S.A., Mar. 2006.
- Chen, P; Robichaud, D; Okumura, M. "Application of cavity enhanced, optical heterodyne spectroscopy to tropospheric isotope chemistry." *Abstr. Pap. Am. Chem. Soc.*, **229**: U722-U722 131-Phys. Part 2, March 13, 2005.
- Chen, P., "Development of a new technique for stable-isotope analysis of tropospheric carbon monoxide based on cavity-enhanced, near-infrared spectroscopy," *First Symposium for the Earth System Scholars Network*, Adelphi, MD, U.S.A., Sep. 2004.
- Chen, P., "Laser spectroscopy for stable-isotopic analysis of atmospheric molecules," *The Ohio State University 58th International Symposium on Molecular Spectroscopy*, Columbus, OH, U.S.A., Jun. 2003.
- Chen P., Siegel, P. H., Pickett H. M., Pearson J. C., and Wyss, R. A., "Optoelectronic terahertz sources based on photomixers," *Far-IR, Sub-mm, & mm Detector Technology Workshop*, Monterey, CA, U.S.A., Apr. 2003.
- Chen, P., de Andrade Garcia, G., Hollberg L. W., Trudeau, M. E., and Tans, P. P., "A mid-infrared spectrometer for stable-isotope analysis of tropospheric methane," *2000 Spring Meeting of the American Geophysical Union*, Washington, D. C., U.S.A., May-Jun. 2000.
- Chen, P., Pearson J. C., Pickett, H. M., Matsuura S., and Blake G. A., "Construction of a three-diode-laser, terahertz, difference-frequency synthesizer and its applications toward spectroscopy of ammonia in the ν_2 state and water in the ground and ν_2 states," *Sixteenth Colloquium on High Resolution Molecular Spectroscopy*, Dijon, France, Sep. 1999.
- Chen, P., Pearson, J. C., Pickett H. M., Matsuura S., and Blake G. A., "A three-diode-laser, terahertz-difference-frequency synthesizer and its applications toward far-infrared spectroscopy of ammonia and water," *3rd Advanced Semiconductor Lasers Applications Meeting*, Santa Barbara, CA, U.S.A., Jul. 1999.

- Chen, P., Matsuura, S., Blake, G. A., Pearson, J. C., and Pickett, H. M., "Molecular spectroscopy with a high-resolution, frequency-calibrated terahertz spectrometer based on optical photomixing in low-temperature-grown GaAs," *The Ohio State University 53rd International Symposium on Molecular Spectroscopy*, Columbus, OH, U.S.A., Jun. 1998.
- Chen, P. and Blake, G. A., "Spectroscopic applications of submillimeter generation by an all-solid-state, optical-heterodyne source," *The Ohio State University 52nd International Symposium on Molecular Spectroscopy*, Columbus, OH, U.S.A., Jun. 1997.
- Chen, P. and Blake, G. A., "Vibrational-rotational-tunneling spectroscopy of N₂-D₂O with an all solid state, optical heterodyne, Submillimeter-wave spectrometer," *The Ohio State University 51st International Symposium on Molecular Spectroscopy*, Columbus, OH, U.S.A., Jun. 1996.
- Chen, P. and Blake, G. A., *43rd Annual Western Spectroscopy Association Conference*, Pacific Grove, CA, U.S.A., Feb. 1996.
- Chen, P. and Blake, G. A., "Spectroscopic applications of optical photomixing at millimeter and submillimeter frequencies," *The Ohio State University 50th International Symposium on Molecular Spectroscopy*, Columbus, OH, U.S.A., Jun. 1995.
- Li, CY; Chen, P; Stutzin, GC; Young, AT; Leung, KN; Kunkel, WB. "Laser diagnostics of the chemical-kinetics of H⁻ ion formation in a low-pressure electric-discharge," *Abstr. Pap. Am. Chem. Soc.*, **201**: 177 Part 2, 1991.
- Young, AT; Chen, P; Kunkel, WB; Leung, KN; Li, CY; Stutzin, GC. "Laser diagnostics of H⁻ formation in a magnetic multicusp ion source," *Conference Record of 1991 IEEE Particle Accelerator Conference: 1916-1918*, 1991.
- Young, AT; Chen, P; Kunkel, WB; Leung, KN; Li, CY; Watson, JM. "Quantum yield measurements of photocathodes illuminated by pulsed ultraviolet laser radiation," *Conference Record of 1991 IEEE Particle Accelerator Conference: 1993-1995*, 1991.

LANGUAGES

- Mandarin Chinese – native language
- English – as proficient and fluent as native speakers.
- German – two years of college coursework, very rusty now.

MEMBERSHIPS

- American Chemical Society (ACS)
- American Geophysical Union (AGU)
- American Physical Society (APS)
- Asia Oceania Geosciences Society (AOGS)
- Division for Planetary Sciences of the American Astronomical Society (DPS)
- Earth System Scholars Network (ESSN)