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## **Education**

- ▶ Ph. D., Materials Science and Engineering (Specialty: Electronic, Photonic and Magnetic Materials), Massachusetts Institute of Technology, Nov. 2006.  
Thesis: GeSi photodetectors and Electroabsorption Modulators for Si Electronic-Photonic Integrated Circuits
- ▶ M. S. with Honor, Materials Physics and Chemistry, Tsinghua University (Beijing, China), Jul. 2001.
- ▶ B. S., Materials Science and Engineering, Tsinghua University, Jul. 1999.

## **Research Interest**

My major research field is electronic and photonic materials and devices for communication, computation, and clean energy applications, including

- ▶ Electronic-photonic integration based on Si nanophotonics, especially active photonic devices (photodetectors, modulators and light emitters) for high speed, low energy consumption optical interconnection in future generations of Tb/s communication and computation systems.
- ▶ Photovoltaic and thermophotovoltaic materials and devices for clean energy harvest.
- ▶ Environmental benign Group IV materials, nanostructures and devices for mid and far infrared detection and imaging.
- ▶ Integrated photonics for THz (T-ray) applications.
- ▶ Metallic and semiconducting silicide materials and devices for electronic and photonic applications.

## **Research Experiences**

- ▶ **GeSi active photonic devices for electronic-photonic integration on a Si platform (2002-present).**  
This research involves the integration of GeSi photodetectors, electroabsorption modulators and light emitters on a silicon platform to achieve electronic-photonic integrated circuits (EPIC) for high bandwidth, low power consumption communication and computation systems. Potential applications include board-to-board and chip-to-chip photonic interconnects for network servers, supercomputers and data centers, on-chip photonic interconnects for multi-core microprocessors, RF photonics, and optical data transmission of high resolution images for HDTV network.
  - First systematic study on **tensile**-strained Ge-on-Si with significantly improved optoelectronic properties for Si-compatible active photonic devices.
  - Designed and fabricated the first waveguide-integrated, ultra-low energy GeSi electroabsorption modulators on SOI with CMOS process.
  - Designed and fabricated high performance, tensile-strained Ge-on-Si photodetectors with an extended optical response to the L-band in telecommunications. Demonstrated the first Ge-on-Si photodiodes monolithically integrated with high-index-contrast waveguides on a Si platform.
  - Proposed and theoretically modeled the approach to engineer the band structure of Ge for light emission and optical gain from its **direct** band gap transition. This proposal became one of the major research directions of the **Si-based Laser Initiative**, a **6-million-dollar** Multidisciplinary University Research Initiative sponsored by the Air Force Office of Scientific Research (AFOSR) from Jul. 2006 to Jul. 2011.
  - Demonstrated **room temperature** photoluminescence, electroluminescence and **optical gain** from the **direct** band gap transition of band-engineered Ge-on-Si.



This research has been sequentially supported by Pirelli, Inc. (Italy), the Defense Advanced Research Projects Agency (DARPA) and the Air Force Office of Scientific Research (AFOSR) under the U. S. Department of Defense (DOD)

- ▶ **Light-trapping photonic structures for solar cell efficiency enhancement (2005-present)**. In this research, reflective grating and photonic crystal structures are applied to increase the optical path length and enhance the efficiency of thin film solar cells. Prototype textured photonic crystal light trapping structure has increased the efficiency of Si thin-film solar cells by 15%, and 47% relative enhancement in efficiency can potentially be achieved with process optimization. The project was sponsored by National Renewable Energy Laboratory (NREL), and is currently sponsored by Abu Dhabi Future Energy Company (United Arab Emirates) and Bosch, Inc (Germany).
- ▶ **Ge-on-Si thermophotovoltaic (TPV) cells (2007-present)**. This research involves integration of high performance Ge/Si TPV cells with a distributed Bragg reflector (DBR) structure. The DBR reflects the photons unable to be absorbed by Ge/Si back to the heat source to further increase its temperature for a more favorable emission spectrum. The device design has been completed, and fabrication is in progress. The project is currently sponsored by Abu Dhabi Future Energy Company (United Arab Emirates).
- ▶ **Ge-on-Si saturable absorbers for Er-Yb mode-locked lasers (2004-2005)**. This research was performed in collaboration with Prof. Franz Kaertner at MIT EECS. The saturable absorber property of epitaxial Ge-on-Si was investigated and a 220 fs Er-Yb mode-locked laser using low loss, broad band Ge saturable absorber was demonstrated.
- ▶ **Low resistivity silicide materials for high quality ohmic contacts in silicon complementary metal oxide semiconductor (CMOS) devices (1999-2001)** This research investigated low resistivity silicide materials compatible with shallow junctions for sub-100 nm CMOS devices. A nanometer thick Pt interlayer has been applied to significantly improve the thermal stability of NiSi, an important silicide material later applied to sub-100 nm CMOS devices in Intel's Pentium processors since 2004. This research was sponsored by China's National Science Foundation.
- ▶ **Synthesis of SiC epitaxial layers on Si (1999-2001)**. Demonstrated epitaxial SiC layers on Si by Metal Vapor Vacuum Arc Ion source (MEVVA) at a relatively low temperature (700 °C). This research was sponsored by China's National Science Foundation.

## **Teaching/Advising Experiences**

Lecture Instructor for MIT course 3.024: Electronic, Photonic, and Magnetic Properties of Materials

Lab Instructor for MIT course 3.003: Principles of Engineering Practice

Guest Lecturer for MIT course 6.152: Micro/Nano Processing Technology

I have also helped to supervise several graduate students in our research group since late 2006. I helped them design and carry out experiments, and suggest solutions to the problems they met in the research.

## **Services at International Conference Committees**

- ▶ Organizing Committee Member, the 2008 Electrochemical Society (ECS) SiGe, Ge and Related Compounds: Material, Processing, and Devices Symposium. (Oct. 2008, Honolulu, Hawaii, USA).
- ▶ Member, IEEE 802.15 Wireless Personal Area Networks THz Science Committee

## **Reviewer Experiences for Scientific Journals:**

I have been serving as a reviewer for 11 scientific journals published by the American Institute of Physics (AIP), the Institute of Electrical and Electronic Engineers (IEEE), the Optical Society of America (OSA), the Electrochemical Society (ECS), and the Minerals, Metals and Materials Society (TMS), as summarized in the following table:



<b>Academic Institute or Society</b>	<b>Journal(s)</b>
AIP	Applied Physics Letters
IEEE	IEEE Journal of Quantum Electronics IEEE Journal of Selected Topics in Quantum Electronics IEEE Journal of Photonics Technology Letters Journal of Lightwave Technology
OSA	Optics Express Optics Letters Applied Optics Journal of the Optical Society of America B
ECS	Electrochemical and Solid-state Letters
TMS	Journal of Electronic Materials

## **Selected Awards and Honors**

- ▶ **Materials Research Society (MRS) Graduate Student Gold Award**, 2004 Materials Research Society (MRS) Fall Meeting, Dec. 2004.
- ▶ **2004 China's National Scholarship for Outstanding Graduate Students Studying Abroad** (awarded in spring 2005)
- ▶ **Master of Science with Honor**, Tsinghua University, 2001
- ▶ **Tung's Oriental Fellowship** (sponsored by the former Chief Executive of Hong Kong, Dr. Tung, Chee-hwa), 2000

## **Membership in Academic Societies**

Member, IEEE, MRS, OSA and ECS.

## **Publications**

### **(a) Journal Papers:**

(The 31 journal papers published in 2000-2008 have been cited more than 380 times by May, 2009 according to Web of Science.)

- [1] **J. F. Liu**, X. C. Sun, L. C. Kimerling and J. Michel  
*"Direct gap Optical Gain of Ge-on-Si at room temperature"*  
To be published in **Optics Letters**, ID 108596 (Accepted on 04/26/2009)
- [2] X. C. Sun, **J. F. Liu**, L. C. Kimerling and J. Michel  
*"Direct gap photoluminescence of n-type tensile-strained Ge-on-Si"*  
To be published in **Applied Physics Letters** (Accepted on 05/14/2009)
- [3] **J. F. Liu**, L. C. Kimerling and J. Michel  
*"Efficient above-band-gap light emission in germanium"* (**invited paper**)  
**Chinese Optics Letters** 7, 271 (2009)



- [4] X. C. Sun, **J. F. Liu**, L. C. Kimerling and J. Michel  
*"Room-temperature direct bandgap electroluminescence from Ge-on-Si light-emitting diodes"*  
**Optics Letters** **34**, 1198 (2009)
- [5] **J. F. Liu**, M. Beals, A. Pomerene, S. Bernardis, R. Sun, J. Cheng, L. C. Kimerling and J. Michel  
*"Waveguide-integrated, ultra-low energy GeSi electro-absorption modulators"*  
**Nature Photonics** **2**, 433 (2008)
- [6] L. Zeng, P. Bermel, Y. Yi, B. A. Alamariu, K. A. Broderick, **J. Liu**, C. Hong, X. Duan, J. Joannopoulos, and Lionel C. Kimerling  
*"Demonstration of enhanced absorption in thin film Si solar cells with textured photonic crystal back reflector"*  
**Applied Physics Letters** **93**, 221105 (2008)
- [7] D. D. Cannon, **J. F. Liu**, D. T. Danielson, S. Jongthammanurak, U. U. Enuha, K. i Wada, J. Michel, and L. C. Kimerling  
*"Germanium-rich silicon-germanium films epitaxially grown by ultrahigh vacuum chemical-vapor deposition directly on silicon substrates"*  
**Applied Physics Letters** **91**, 252111 (2007)
- [8] **J. F. Liu**, X. C. Sun, D. Pan, X. X. Wang, L. C. Kimerling, T. L. Koch and J. Michel,  
*"Tensile-strained, n-type Ge as a gain medium for monolithic laser integration on Si"*  
**Optics Express** **15**, 11272 (2007)
- [9] N. N. Feng, J. Michel, L. Zeng, **J. F. Liu**, C. Y. Hong, L. C. Kimerling, and X. Duan  
*"Design of highly efficient light-trapping structures for thin-film crystalline silicon solar cells"*  
**IEEE Transactions on Electronic Devices** **54**, 1926 (2007)
- [10] D. Ahn, C. Y. Hong, **J. F. Liu**, M. Beals, L. C. Kimerling, and J. Michel,  
*"High performance, waveguide integrated Ge photodetectors"*  
**Optics Express** **15**, 3916 (2007)
- [11] **J. F. Liu**, D. Pan, S. Jongthammanurak, K. Wada, L. C. Kimerling, and J. Michel,  
*"Design of monolithically integrated GeSi electroabsorption modulators and photodetectors on an SOI platform"*  
**Optics Express** **15**, 623 (2007)
- [12] S. Jongthammanurak, **J. F. Liu**, K. Wada, D. D. Cannon, D.T. Danielson, D. Pan, L. C. Kimerling and J. Michel,  
*"Large Electro-optic Effect in Tensile Strained Ge-on-Si Films"*  
**Applied Physics Letters** **89**, 161115 (2006)
- [13] L. Zeng, Y. Yi, C. Hong, **J. F. Liu**, N. N. Feng, X. Duan, L.C. Kimerling and B. A. Alamariu,  
*"Efficiency Enhancement in Si Solar Cells by Textured Photonic Crystal Back Reflector"*  
**Applied Physics Letters** **89**, 111111 (2006)
- [14] X.X. Wang, **J. F. Liu**, B. W. Cheng, J. Z. Yu, and Q. M. Wang  
*"Metal catalysis-free, direction-controlled planar growth of single-crystalline  $\alpha$ -Si<sub>3</sub>N<sub>4</sub> nanowires on Si (100) substrate"*  
**Nanotechnology** **17**, 3989 (2006)
- [15] **J. F. Liu**, J. Michel, W. Giziewicz, D. Pan, D. D. Cannon, D.T. Danielson, S. Jongthammanurak, K. Wada, and L. C. Kimerling  
*"High-performance, tensile-strained Ge p-i-n photodetectors on a Si platform"*  
**Applied Physics Letters** **87**, 103501 (2005)
- [16] **J. F. Liu**, D. D. Cannon, K. Wada, Y. Ishikawa, S. Jongthammanurak, D. T. Danielson, J. Michel, and L. C. Kimerling  
*"Tensile strained Ge p-i-n photodetectors on Si platform for C and L band optical communications"*  
**Applied Physics Letters** **87**, 011110 (2005)



- [17] Y. Ishikawa, K. Wada, **J. F. Liu**, D. D. Cannon, H. C. Luan, J. Michel, and L. C. Kimerling  
"Strain-induced enhancement of near-infrared absorption in Ge epitaxial layers grown on Si substrate"  
**Journal of Applied Physics** **98**, 013501 (2005)
- [18] S. Akiyama, F. J. Grawert, **J. Liu**, K. Wada, G. K. Celler, L. C. Kimerling, and F. X. Kaertner  
"Fabrication of highly reflecting epitaxy-ready Si-SiO<sub>2</sub> Bragg reflectors"  
**IEEE Photonics Technology Letters** **17**, 1456 (2005)
- [19] F. J. Grawert, J. T. Gopinath, F. Ö. Ilday, H. M. Shen, E. P. Ippen, F. X. Kärtner, S. Akiyama, **J. Liu**, K. Wada, L. C. Kimerling  
"220-fs erbium-ytterbium:glass laser mode locked by a broadband low-loss silicon germanium saturable absorber"  
**Optics Letters** **30**, 329 (2005)
- [20] **J. F. Liu**, D. D. Cannon, K. Wada, Y. Ishikawa, D. T. Danielson, S. Jongthammanurak, J. Michel, and L. C. Kimerling,  
"Deformation potential constants of biaxially tensile stressed Ge epitaxial films on Si(100)",  
**Physical Review B** **70**, 155309 (2004)
- [21] **J. F. Liu**, D. D. Cannon, K. Wada, Y. Ishikawa, D. T. Danielson, S. Jongthammanurak, J. Michel, and L. C. Kimerling,  
"Silicidation-induced band gap shrinkage in Ge epitaxial films on Si",  
**Applied Physics Letters** **84**, 660 (2004).
- [22] D. D. Cannon, **J. F. Liu**, Y. Ishikawa, K. Wada, D. T. Danielson, S. Jongthammanurak, J. Michel, and L. C. Kimerling,  
"Tensile strained epitaxial Ge films on Si(100) substrates with potential application in L-band telecommunications",  
**Applied Physics Letters** **84**, 906 (2004)
- [23] O. I. Dosunmu, D. D. Cannon, M. K. Emsley, B. Ghyselen, **J. F. Liu**, L. C. Kimerling, and M. S. Unlu,  
"Resonant cavity enhanced Ge photodetectors for 1550 nm operation on reflecting Si substrates"  
**IEEE Journal of Selected Topics in Quantum Electronics** **10**, 694 (2004)
- [24] Y. Ishikawa, K. Wada, D. D. Cannon, **J. F. Liu**, H. C. Luan, and L. C. Kimerling,  
"Strain-induced band gap shrinkage in Ge grown on Si substrate",  
**Applied Physics Letters** **82**, 2044 (2003).
- [25] **J. F. Liu**, J. Y. Feng and W. Z. Li  
"Reduction of the tensile stress in CoSi<sub>2</sub> films by pre-deposition carbon ion implantation"  
**Nuclear Instrument & Methods in Physics Research B-Beam Interactions with Materials and Atoms** **194**, 289 (2002)
- [26] **J. F. Liu**, J. Y. Feng, and J. Zhu,  
"Film thickness dependence of the NiSi-to-NiSi<sub>2</sub> transition temperature in the Ni/Pt/Si(100) system"  
**Applied Physics Letters** **80**, 270 (2002)
- [27] **J. F. Liu**, J. Y. Feng, and J. Zhu,  
"Comparison of the thermal stability of NiSi films in Ni/Pt/(111)Si and Ni/Pt/(100)Si systems"  
**Journal of Applied Physics** **90**, 745 (2001)
- [28] Z. Q. Liu, **J. F. Liu**, J. Y. Feng and W. Z. Li,  
"Low-temperature, direct synthesis of beta-SiC by metal vapor vacuum arc ion source implantation"  
**Materials Letters** **50**, 275 (2001)
- [29] Z. Q. Liu, **J. F. Liu**, J. Y. Feng and W. Z. Li  
"Low temperature synthesis of beta-SiC by a metal vapor vacuum arc ion source"  
**Diamond and Related Materials** **10**, 2195 (2001)



- [30] **J. F. Liu**, J. Y. Feng and W. Z. Li  
“Effect of pre-Co-deposition  $C^+$  implantation on the stress level of  $CoSi_2$  films formed on  $Si(100)$  substrates”  
**Semiconductor Science and Technology** **16**, 273 (2001)
- [31] **J. F. Liu**, J. Y. Feng, B. Li and J. Zhu,  
“Solid phase reaction between crystalline, (002) oriented Co film and  $Si(111)$  substrate: Preferential orientations of silicides”  
**Journal of Materials Science Letters** **20**, 803 (2001)
- [32] **J. F. Liu**, H. B. Chen and J. Y. Feng  
“Enhanced thermal stability of  $NiSi$  films on  $Si(111)$  substrates by a thin Pt interlayer”  
**Journal of Crystal Growth** **220**, 488 (2000)
- [33] **J. F. Liu**, J. Y. Feng and J. Zhu  
“Growth of epitaxial  $CoSi_2$  films on  $Si(100)$  substrates through direct solid phase reaction between crystalline Co films and Si substrates”  
**Journal of Crystal Growth** **218**, 272 (2000)
- [34] **J. F. Liu**, H. B. Chen, J. Y. Feng and J. Zhu  
“Improvement of the thermal stability of  $NiSi$  films by using a thin Pt interlayer”  
**Applied Physics Letters** **77**, 2177 (2000)
- [35] **J. F. Liu**, J. Y. Feng, B. Li and J. Zhu  
“Study on the solid state reaction between crystalline Co film and  $Si(111)$  substrate”  
**Journal of Crystal Growth** **209**, 795 (2000)

### **(b) Book Chapters:**

- [1] K. Wada, **J. F. Liu**, S. Jongthammanurak, D. D. Cannon, D. T. Danielson, D. H. Ahn, S. Akiyama, M. Popovic, D.R. Lim, K. K. Lee, H.-C. Luan, Y. Ishikawa, X. Duan, J. Michel, H. A. Haus, and L. C. Kimerling,  
“Si microphotonics for optical interconnection”  
in the book **Optical Interconnects: Springer Series in Optical Sciences (2006), Vol. 119**, p291-310. CODEN: SSOSDB ISSN:0342-4111. CAN 145:219827 AN 2006:345319 CAPLUS
- [2] L. C. Kimerling, L. Dal Negro, S. Saini, Y. Yi, D. Ahn, S. Akiyama, D. Cannon, **J. Liu**, J. G. Sandland, D. Sparacin, J. Michel, K. Wada K, M. R. Watts  
“Monolithic silicon microphotonics”  
in the book **Silicon Photonics: Topics in Applied Physics Series, Vol. 94**, p 89, Springer-Verlag, Berlin, 2004

### **(c) Conference Papers:**

- [1] **J. F. Liu** and J. Michel  
“High Performance Ge Devices for Electronic-Photonic Integrated Circuits”  
**ECS Transactions, Vol 16**, p 575-582 (2008) (invited paper)
- [2] X. C. Sun, **J. F. Liu**, L. C. Kimerling and J. Michel  
“Optical Bleaching of Thin Film Ge on Si”  
**ECS Transactions, Vol 16**, p 881-889 (2008)
- [3] **J. F. Liu**, M. Beals, A. Pomerene, S. Bernardis, R. Sun, J. Cheng, L. C. Kimerling, and J. Michel  
“Ultralow Energy, Integrated GeSi Electroabsorption Modulators on SOI”  
**5<sup>th</sup> IEEE International Conference on Group IV Photonics** (IEEE Catalog Number: CFP08GFP-CDR), p10-12 (Sept. 2008, Sorrento, Italy)
- [4] **J. F. Liu**, X. C. Sun, P. Becla, L. C. Kimerling and J. Michel  
“Towards a Ge Laser for CMOS Applications”



- 5<sup>th</sup> IEEE International Conference on Group IV Photonics** (IEEE Catalog Number: CFP08GFP-CDR), p16-18 (Sept. 2008, Sorrento, Italy) **(invited paper)**
- [5] **J. F. Liu**, M. Beals, A. Pomerene, S. Bernardis, R. Sun, J. Cheng, L. C. Kimerling, and J. Michel  
*"Integrated GeSi Electro-Absorption Modulators on SOI"*  
**2008 OSA Conference on Integrated Photonics and Nanophotonics research and Application**  
(Jul. 2008, Boston, MA, USA), paper # IMC2
- [6] J. Cheng, W. Giziewicz, **J. F. Liu**, C. Y. Hong, L. C. Kimerling, and J. Michel  
*"High-Speed Large Area Ge on Si Photodetectors"*  
**2008 OSA Conference on Integrated Photonics and Nanophotonics research and Application**  
(Jul. 2008, Boston, MA, USA), paper # IMC4
- [7] X. C. Sun, **J. F. Liu**, L. C. Kimerling, and J. Michel  
*"Band-Engineered Ge as Gain Medium for Si-Based Laser"*  
**2008 OSA Conference on Integrated Photonics and Nanophotonics research and Application**  
(Jul. 2008, Boston, MA, USA), paper # IMC5
- [8] M. Beals, J. Michel, **J. F. Liu**, D. Ahn, D. Sparacin, R. Sun, C. Y Hong, L. C. Kimerling, A. Pomerene, D. Carothers, J. Beattie, A. Kopa, and A. Apsel  
*"Process flow innovations for photonic device integration in CMOS"*  
**Proceedings of the International Society for Optical Engineering (SPIE) 6898**, 689804 (Jan. 2008, San Jose, CA, USA) **(invited paper)**
- [9] **J. F. Liu**, D. Ahn, S. Jongthammanurak, D. Pan, C. Y. Hong, M. Beals, L. C. Kimerling and J. Michel,  
*"Ge-based active devices for Si photonics"*  
**4<sup>th</sup> IEEE International Conference on Group IV Photonics**, p 274-276 (Sept. 2007, Tokyo, Japan)  
**(invited paper)**
- [10] **J. F. Liu**, D. Ahn, C. Y. Hong, M. Beals, L. C. Kimerling, J. Michel, J. Chen and F. X. Kaertner, A. T. Pomerene, D. Carothers, C. Hill, and J. Beattie, K. Y. Tu, Y. K. Chen, S. Patel, M. Rasras, A. White and D. M. Gill  
*"Waveguide-integrated Ge Photodetectors on Si for Electronic and Photonic Integration"*  
**2007 OSA Conference on Integrated Photonics and Nanophotonics Research and Applications (IPNRA), ITUE2** (July 2007, Salt Lake City, USA)
- [11] J. Michel, **J.F. Liu**, D.H. Ahn, D. Sparacin, R. Sun, C.Y. Hong, W.P. Giziewicz, M. Beals, L. C. Kimerling, A. Kopa, A. B. Apsel, M. S. Rasras, D. M. Gill, S. S. Patel, K.Y. Tu, Y. K. Chen, A. E. White, A. Pomerene, D. Carothers, and M. J. Grove,  
*"Advances in Fully CMOS Integrated Photonic Circuits"*,  
**Proceedings of the International Society for Optical Engineering (SPIE) 6477**, p 64770P-1-11,  
(Jan. 2007, San Jose, CA, USA) **(invited paper)**
- [12] **J. F. Liu**, D. Pan, S. Jongthammanurak, D. Ahn, C. Y. Hong, M. Beals, L. C. Kimerling and J. Michel,  
*"Waveguide-Integrated Ge p-i-n Photodetectors on SOI Platform"*  
**3<sup>rd</sup> IEEE International Conference on Group IV Photonics**, p 173 (Sept. 2006, Ottawa, Canada)
- [13] **J. F. Liu**, D. Ahn, C. Y. Hong, D. Pan, S. Jongthammanurak, M. Beals, L. C. Kimerling, and J. Michel, A. T. Pomerene, D. Carothers, C. Hill, and M. Jaso, K. Y. Tu, Y. K. Chen, S. Patel, M. Rasras, D. M. Gill, and A. E. White,  
*"Waveguide Integrated Ge p-i-n Photodetectors on a Silicon-on-Insulator Platform"*  
**5<sup>th</sup> IEEE/LEOS (Laser and Electro-optics Society) International Symposium on Optoelectronics in the Optical Valley of China**, (Nov. 2006, Wuhan, China) **(invited paper)**
- [14] S. Jongthammanurak, **J. F. Liu**, K. Wada, D. D. Cannon, D. T. Danielson, D. Pan, L. C. Kimerling, J. Michel,  
**3<sup>rd</sup> IEEE International Conference on Group IV Photonics**, p 34 (Sept. 2006, Ottawa, Canada)
- [15] L. Zeng, Y. Yi, C. Y. Hong, B. A. Alamariu, **J. F. Liu**; X. M. Duan, Lionel C. Kimerling,



*"New solar cells with novel light trapping via textured photonic crystal back reflector"*

**Materials Research Society Symposium Proceedings Vol.891**, article number 0891-EE06-06, (Nov.-Dec. 2005, Boston, USA)

- [16] J. Michel, **J. F. Liu**, W. Giziewicz, D. Pan, D. D. Cannon, D. T. Danielson, S. Jongthammanurak, K. Wada, and Lionel C. Kimerling,  
*"High Performance Ge p-i-n Photodetectors on Si"*  
**2<sup>nd</sup> IEEE International Conference on Group IV Photonics**, p 177 (Sept. 2005, Antwerp, Belgium).  
(invited paper)
- [17] K. Wada, **J. F. Liu**, S. Jongthammanurak, D. D. Cannon, D. T. Danielson, Y. Ishikawa, A. Eshed, C. Y. Hong, J. Michel and L. C. Kimerling,  
*"Direct integration of Ge detectors and modulators on the Si microphotonics platform"***1st IEEE International Conference on Group IV Photonics**, p 40 (Sept. 2004, Hong Kong, China) (invited paper)
- [18] **J. F. Liu**, J. Michel, D. D. Cannon, W. Giziewicz, D. Pan, D. T. Danielson, S. Jongthammanurak, J. Yasaitis, K. Wada, C. G. Fonstad and L. C. Kimerling,  
*"High Speed Ge Photodetectors on Si Platform for GHz Optical Communications in C+L Bands"*  
**Materials Research Society Symposium Proceedings**, Vol 829, article number B 6.9. (Dec. 2004, Boston)
- [19] F. J. Grawert, S. Akiyama, J. T. Gopinath, F. O. Ilday, **J. Liu**, H. Shen, K. Wada, L. C. Kimerling, E. P. Ippen and F. X. Kaertner,  
*"Silicon-germanium saturable absorber mirrors"*  
**2004 IEEE Laser and Electro-optics (LEOS) Annual Meeting Conference Proceedings**, pt. 2, Vol. 2, p 735 (Nov. 2004, Puerto Rico)
- [20] **J. F. Liu**, J. Michel, W. Giziewicz, D. D. Cannon, S. Jongthammanurak, D. T. Danielson, D. Pan, J. Yasaitis, K. Wada and L. C. Kimerling  
*"A 20 GHz, tensile strained Ge photodetector on Si platform with detection spectrum for optical communications and on-chip applications"*  
**2004 IEEE Laser and Electro-optics (LEOS) Annual Meeting Conference Proceedings** pt. 1, Vol. 1, p 150 (Nov. 2004, Puerto Rico)
- [21] **J. F. Liu**, D. D. Cannon, K. Wada, Y. Ishikawa, D. T. Danielson, S. Jongthammanurak, J. Michel, and L. C. Kimerling,  
*"Strain-engineered Ge photodetectors on Si platform for broad band optical communications"*,  
**Proceedings of the Conference of Laser and Electro-optics (CLEO)**, San Francisco, May 2004, p. IThR1
- [22] O. I. Dosunmu, D. D. Cannon, M. K. Emsley, B. Ghyselen, **J. Liu**, L. C. Kimerling and M. S. Unlu,  
*"Germanium on double-SOI photodetectors for 1550-nm operation"*  
**Proceedings of the SPIE - The International Society for Optical Engineering**, v 5353, n 1, p 65 (Jan. 2004, San Jose)
- [23] D. D. Cannon, S. Jongthammanurak, **J. Liu**, D.T. Danielson, K. Wada, J. Michel, and L.C. Kimerling,  
*"Near-infrared Ge Photodetectors Fabricated on Si Substrates with CMOS Technology"*,  
in **Materials Research Society Symposium Proceedings: Optoelectronics of Group-IV-Based Materials**, edited by Tom Gregorkiewicz, Robert G. Elliman, Philippe M. Fauchet, and James A. Hutchby, San Francisco, April 2003, Vol. 770, article number I.2.3.
- [24] D. D. Cannon, H.-C. Luan, D.T. Danielson, S. Jongthammanurak, **J. Liu**, J. Michel, K. Wada, and L.C. Kimerling,  
*"Monolithic Si-based technology for optical receiver circuits"*,  
**Proceedings of the International Society for Optical Engineering**, 4999 145 (2003) (invited paper)





## **Invited Talks:**

### **[1] Jifeng Liu**

*"Light up the Future of Si Microprocessors"*

**217<sup>th</sup> Electrochemical Society Meeting** (May. 2009, San Francisco, USA)

### **[2] Jifeng Liu**

*"Integrated Photonics for THz Applications"*

**IEEE 802.15: Wireless Personal Area Networks Conference** (Nov. 2008, Dallas, USA)

### **[3] Jifeng Liu**

*"Ge-based Active Devices for Si Photonics"*

**4<sup>th</sup> IEEE/LEOS International Conference on Group IV Photonics** (Sept. 2007, Tokyo, Japan)

### **[4] Jifeng Liu**

*"CMOS-Compatible, High Performance Tensile Strained Ge P-I-N Photodetectors on Si"*

**2005 American Vacuum Society Symposium**, New England Chapter, June 2005, Burlington, MA, USA)

## **Patents:**

### **Patents Granted**

#### **[1] Donghwan Ahn, Jifeng Liu, Jurgen Michel and Lionel C. Kimerling**

*"Vertically-integrated waveguide photodetector apparatus and related coupling methods"*, **U. S. Patent No. 7,305,157**

#### **[2] Donghwan Ahn, Jifeng Liu, Jurgen Michel and Lionel C. Kimerling**

*"Integrated waveguide photodetector apparatus with matching propagation constants and related coupling methods"*, **U. S. Patent No. 7,266,263**

#### **[3] Kazumi Wada, Lionel C. Kimerling, Yasuhiko Ishikawa, Douglas D. Cannon, and Jifeng Liu**

*"Method of Forming Ge Photodetectors"*, **U. S. Patent No. 6,946,318**

#### **[4] Kazumi Wada, Douglas D. Cannon, Jifeng Liu, Lionel C. Kimerling, and Yasuhiko Ishikawa,**

*"Ge Photodetectors"*, **U.S. Patent No. 6,812,495**

### **Patents Pending Approval**

#### **[1] Jifeng Liu, Dong Pan, Jurgen Michel and L. C. Kimerling**

*"High Speed and Low Loss GeSi/Si Electro-absorption Light Modulator Integrated with Waveguides and Photodetectors and Method of Fabrication Using Selective Growth"*

U.S. Patent Publication No. 20070116398; International Patent Publication No. WO2007061986

#### **[2] Jifeng Liu, Dong Pan, Lionel C. Kimerling, Jurgen Michel and Sajan Saini,**

*"Method and Structure of Germanium Laser on Silicon"*,

U.S. Patent Publication No. 20070105251; International Patent Publication No. WO2007053431

#### **[3] Dong Pan, Jifeng Liu, Jurgen Michel, John Yasaitis, and Lionel C. Kimerling,**

*"Method of fabricating Ge or SiGe/Si waveguide or photonic crystal structures by selective growth"*,

U.S. Patent Publication No. 20070025670; International Publication No. WO2007016070

#### **[4] Jifeng Liu, Douglas D. Cannon, Kazumi Wada, Samerkhoe Jongthammanurak, David T. Danielson, Jurgen Michel and Lionel C. Kimerling,**

*"Method and Structure of Strain Control of SiGe Based Photodetectors and Modulators"*

U.S. Patent Publication No. 20070286952; International Patent Publication No. WO2005010965

#### **[5] Donghwan Ahn, Jifeng Liu, J. Michel and L. C. Kimerling**



*"Laterally-integrated waveguide photodetector apparatus and related coupling methods"*  
U.S. Patent Publication No. 20070104441; International Publication No. WO2007055739

**[6]** Dong Pan, **Jifeng Liu**, Lionel C. Kimerling, James F. McMillan, Michael D. Sockin, and Chee Wei Wong

*"Ultrafast Ge/Si resonator-based modulators for optical data communications in Si photonics"*  
International Publication No. WO2007084600

**[7]** **Jifeng Liu**, Jurgen Michel and Lionel C. Kimerling

*"Silicon-germanium reflective electroabsorption modulators in the visible light regime"*  
MIT case number 13329

**[8]** **Jifeng Liu**, Jurgen Michel and Lionel C. Kimerling

*"Electroabsorption modulators driven by input optical power"*  
MIT case number 13330

**[9]** **Jifeng Liu**, Jurgen Michel and Lionel C. Kimerling

*"Monolithic broad-band laser and electroabsorption modulator arrays based on strain orientation engineering for on-chip wavelength division multiplexing"*  
MIT case number 13562