

Dr. Yunbo Guo

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EDUCATION

- May 2010 **Ph.D.** Electrical Engineering and Nanobiology Certificate, University of Michigan, Ann Arbor (GPA:3.9/4.0)
Thesis: *Sensitive, label-free biomolecular binding detection using a one-dimensional photonic crystal sensor*
Chair: Professor Theodore B. Norris
- July 2005 **M. E.** Optical Engineering, Tsinghua University, Beijing, China (GPA: 3.7/4.0)
Thesis: *Study on optimization of holographic storage properties and application of lithium niobate crystals*
- July 2002 **B. E.** Mechanical Engineering, Tsinghua University, Beijing, China (GPA: 3.6/4.0)

RESEARCH EXPERIENCE

- June 2010 **Research Fellow** (Advisor: Xudong Fan)
-Present Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI
- Developing a new optical fiber biosensor
- Jan. 2006 **Doctorate Researcher** (Advisors: Theodore B. Norris and James R. Baker, Jr.)
-May 2010 Center for ultrafast optical science and Michigan nanotechnology institute for medicine and biological sciences, University of Michigan, Ann Arbor, MI
Principle researcher of an NIH-funded project "Photonic crystal for biomolecular detection"
- Performed comprehensive studies of principle, simulation, design, fabrication and demonstration of this photonic crystal-based biosensor
- Developed a prototype optical system and demonstrated its capability of detecting the binding of very small molecules (< 100 Da), DNA oligonucleotides, proteins and antibodies (> 150 kDa)
- Presented on weekly group meeting, symposiums, institute seminars and scientific conventions
- Participated in commercialization which includes: design, prototype and demonstration
- Co-wrote a U.S. patent application (issued) and annual project progress reports
- Co-wrote a successfully funded NIH grant for \$400,540 with senior researchers
- Collaborated with biologists and chemists on surface chemistry and bimolecular detection
Principle investigator of a university project "A novel plasmon excitation mechanism"
- Conceived and developed a novel broad-band (> 100 MHz), all-optical ultrasound transducer
- Conceived a novel total-internal-reflection fluorescence microscopy for single molecule detection
- Wrote a patent application, and got Rackham graduate student research grant for \$3000.
- Sept. 2002 **Graduate Research Assistant** (Advisors: Qingsheng He and Guofan Jin)
- July 2005 Institute of opto-electronic Engineering, Tsinghua University, Beijing, China
Principle researcher of a Chinese government-funded scientific research project "Optimization of compact holographic data storage and correlation recognition system"
- Built multiple holographic experimental platforms and developed corresponding control systems
- Proposed and demonstrated a new way to improve properties of photorefractive crystals
- Derived a new exposure time schedule suitable for large capacity holographic data storage
- Achieved, for the first time, high storage density of 21Gb/cm³ in doubly doped LiNbO₃ crystals

AWARDS AND HONORS

- 2010 Rackham Graduate Student Research Grant \$3000, *the University of Michigan*
2010 Newport Spectra-Physics Excellence Research Travel Award, *SPIE Photonic West*

- 2009 First prize of poster competition in Optics at *Engineering Graduate Symposium*
 2009 First prize of poster competition in *Herbert D. Doan Nanotechnology Symposium*
 2008-2010 Rackham conference travel grant, *the University of Michigan*
 2008 First prize of poster competition in Biomedical imaging at *Engineering Graduate Symposium*
 2007-2008 Riethmiller fellowship, *the University of Michigan*
 2005-2006 EECS department fellowship, *the University of Michigan*
 2004 National scientific and technological achievement award, *China Ministry of Education*
 2004 Excellent research award, *Tsinghua University*
 2001 Excellent academic award, *Tsinghua University*
 1999 Outstanding student award, *Tsinghua University*
 1998 Outstanding freshman award, *Tsinghua University*

PATENTS

- [2] **Y. Guo***, T. B. Norris, J. R. Baker, Jr., L. J. Guo, and N. G. Walter, "Photonic Crystal - Metallic Device and Applications," U.S. Provisional Patent Application, Serial No. 61/349,440, filed on May 28th, 2010.
 [1] J. Y. Ye, **Y. Guo**, T. B. Norris, and J. R. Baker, Jr., "Photonic Crystal Sensor," US Patent 7,639,362 (2009)
A start-up company was newly founded based on the issued patent and my Ph.D. research work

PUBLICATIONS

- [15] **Y. Guo***, J. Y. Ye, C. Divin, B. Huang, T. P. Thomas, J. R. Baker, Jr. and T. B. Norris, "Real-time biomolecular binding detection using a sensitive photonic crystal biosensor," *Anal. Chem.* **82**, 5211-5218 (2010).
 [14] C. M. Chow, Y. Zhou, **Y. Guo**, T. B. Norris, X. Wang, C. X. Deng and J. Y. Ye, "High-frequency ultrasonic sensor using an open-cavity photonic crystal structure," revision submitted to *Journal of Biomedical Optics*
 [13] C. M. Chow, Y. Zhou, **Y. Guo**, T. B. Norris, X. Wang, C. X. Deng and J. Y. Ye, "Optoacoustic sensor with a unique open-cavity structure," paper BMG2, *OSA Topical meeting on Biomedical Optics* (2010).
 [12] **Y. Guo***, J. Y. Ye, T. P. Thomas, J. R. Baker, Jr. and T. B. Norris, "Label-free measurement of DNA oligomer binding using a highly-sensitive photonic crystal biosensor," paper CTuN5, *CLEO* (2010).
 [11] **Y. Guo***, J. Y. Ye, B. Huang, D. McNerny, T. P. Thomas, J. R. Baker, Jr. and T. B. Norris, "Real-time small molecule binding detection using a label-free photonic crystal biosensor," *Proc. SPIE* **7553**, 755303 (2010).
 [10] **Y. Guo***, T. P. Thomas, J. Y. Ye, A. Myc, J. R. Baker, Jr. and T. B. Norris, "Real-time, label-free protein binding detection with a one dimensional photonic crystal sensor," paper CTuCC6, *CLEO* (2009).
 [9] **Y. Guo***, J. Y. Ye, C. Divin, T. P. Thomas, A. Myc, T. Begey, J. Baker and T. B. Norris, "Label-free biosensing using a photonic crystal structure in a total-internal-reflection geometry," *Proc. SPIE* **7188**, 71880B (2009).
 [8] **Y. Guo***, J. Y. Ye, C. Divin, A. Myc, J. R. Baker, Jr. and T. B. Norris, "Optical biosensor based on one-dimensional photonic crystal in a total-internal-reflection geometry," paper CThZ3, *CLEO* (2008).
 [7] **Y. Guo**, C. Divin, A. Myc, F. L. Terry, Jr., J. R. Baker, Jr., T. B. Norris and J. Y. Ye, "Sensitive bioassay using a photonic crystal structure in total internal reflection," *Opt. Express* **16**, 11741 -11749 (2008).
 [6] G. Liu, J. Wang, **Y. Guo** and S. Wang, "The influence of photovoltaic Dc field on holographic correlation recognition," *Proc. SPIE* **6027**, 60272J (2006).
 [5] Q. He, **Y. Guo***, Y. Liao, L. Cao, G. Liu and G. Jin, "Holographic properties of doubly doped lithium niobate crystals with Indium," *Proc. SPIE* **5636**, 312-320 (2005).
 [4] Q. He, Y. Liao, **Y. Guo**, L. Cao, X. Ma and G. Jin, "Improvement to large capacity pattern recognition using speckle modulation and suitable time schedule," *Proc. SPIE* **5636**, 321-328 (2005).
 [3] **Y. Guo***, Y. Liao, L. Cao, G. Liu, Q. He and G. Jin, "Improvement of photorefractive properties and holographic applications of lithium niobate crystal," *Opt. Express* **12**, 5556-5561 (2004).
 [2] Y. Liao, **Y. Guo**, L. Cao, X. Ma, Q. He and G. Jin, "Experiment on parallel correlated recognition of 2030 human faces based on speckle modulation," *Opt. Express* **12**, 4047-4052 (2004).
 [1] **Y. Guo***, J. Wang, Q. He, M. Wu and G. Jin, "Study of the holographic storage properties of In: Fe: LiNbO₃ crystal in electrolytic solution," *General Congress of Chinese Optical Society*, NO.6, 110-114 (2004).

* Corresponding author

PRESENTATIONS

- Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2010 (Oral presentation)
"Label-free measurement of DNA oligomer binding using a highly-sensitive photonic crystal biosensor"
- Nanobiology Certificate Program Seminar*, University of Michigan, Ann Arbor, MI, April 2010 (Oral presentation)
"Photonic Crystal-Metallic Structure and Applications"
- SPIE Photonic West*, San Francisco, CA, Jan. 2010 (Oral presentation)
"Real-time small molecule binding detection using a novel photonic crystal biosensor"
- Engineering Graduate Symposium*, Ann Arbor, MI, Nov. 2009 (Oral and poster presentation)
"Label-free small molecule and protein detection by a highly sensitive optical biosensor"
- MNIMBS Institute Meeting*, Ann Arbor, MI, Oct. 2009 (Invited talk)
"A novel label-free photonic crystal biosensor"
- Herbert D. Doan Nanotechnology Symposium*, Ann Arbor, MI, Sept. 2009 (Poster presentation)
"Photonic crystal biosensor"
- Conference on Lasers and Electro-Optics (CLEO)*, Baltimore, MD, June 2009 (Oral presentation)
"Real-time, label-free protein binding detection with a one dimensional photonic crystal sensor"
- SPIE Photonic West*, San Jose, CA, Jan. 2009 (Oral presentation)
"Label-free biosensing using a photonic crystal structure in a total-internal-reflection geometry"
- Engineering Graduate Symposium*, Ann Arbor, MI, Nov. 2008 (Oral and poster presentation)
"Biosensor using a photonic crystal structure in a total-internal-reflection geometry"
- Conference on Lasers and Electro-Optics (CLEO)*, San Jose, CA, May 2008(Oral presentation)
"Optical biosensor based on 1D photonic crystal in a total-internal-reflection geometry"
- MNIMBS Institute Meeting*, University of Michigan, Ann Arbor, MI, April 2008 (Oral presentation)
"A novel label-free, real-time optical sensor for biomedical application"
- SPIE Photonic East*, Beijing, China, Nov. 2004 (Oral presentation)
"Improvement of photorefractive properties and holographic applications of LiNbO₃ crystal"
- General Congress of Chinese Optical Society*, Hangzhou, China, Apr. 2004 (Oral presentation)
"Study of the holographic storage properties of In: Fe: LiNbO₃ crystal in electrolytic solution"

SKILLS

Broad-based, hands-on engineering and laboratory skills for multidisciplinary research

Expertise in optical and ultrasound devices and systems design, modeling, fabrication and testing

- optical spectroscopy (transmission and reflectance, ellipsometry, spectrophotometer, AFM)
- thin film fabrication (Si, Ti, Au, SiO₂) by electron-beam evaporation and spin coating (PMMA, PDMS)
- polymer-based microfluidics channel design and fabrication
- surface chemistry, protein engineering and biomolecular detection
- optical fiber system

Design and fabrication of electrical and mechanical parts in instrument shops

Programming skills: Matlab, Origin, LabView, AutoCAD, Zemax, C and OptiFDTD

PROFESSIONAL ACTIVITIES

Reviewer for *Applied Physics Letters*, *Optics Express*, *Applied Optics*

Member of Optical Society of America (OSA)

Member of the International Society for Optical Engineering (SPIE)