

Yong-Seok Choi

University of California, Santa Barbara
California NanoSystems Institute (CNSI)
Santa Barbara, CA 93106-6105
Office: (805) 893-4875
cys@cnsi.ucsb.edu

EDUCATION	Korea Advanced Institute of Science and Technology; KAIST Ph. D. in Physics, August 2004 Thesis Title: Active Photonic Crystal Structures based on Zero-Dimensional Active Materials: Er-doped Si and InGaAs QD Advisor: Professor Yong-Hee Lee	Daejeon, Korea
	Korea Advanced Institute of Science and Technology; KAIST M. S. in Physics, February 2000 Thesis Title: Frequency Stabilization of Diode Lasers for High Resolution Spectroscopy Advisor: Professor Kyungwon An	Daejeon, Korea
	YONSEI University B. S. in Physics, February 1998	Seoul, Korea
RESEARCH EXPERIENCES	Assistant Project Scientist <i>University of California-Santa Barbara, California NanoSystems Institute</i> Advisor: Professor Evelyn L. Hu Coordinating a DOE-funded Solid-State Lighting project under the supervision of Prof's. Evelyn L. Hu, James S. Speck, and Claude Weisbuch. The goal of this project is to explore the maximum efficacy of photonic-crystal light-emitting diodes (PhC-LEDs). As an assistant project scientist, I am in charge of organizing regular meetings, providing guidance for junior colleagues, and writing regular (monthly, 6-month, and 1-year) reports to the project monitor of DOE. As a specific research subject, I carry out process development for submicron-thin PhC-LEDs utilizing flip-chip bonding and laser lift-off techniques; Expertise on numerical simulation, device design, nanofabrication, and optical characterization with strong background of semiconductor optoelectronics. On-going research on solid-state cavity quantum-electro-dynamics (QED) and coherent optical process in coupled nanophotonics systems.	Santa Barbara, CA 9/2006 – present
	Postgraduate Researcher <i>University of California-Santa Barbara, California NanoSystems Institute</i> Initiated the intensity-correlation measurements to study coherent-state transition in quantum-dot (QD) nanolasers with ultrahigh spontaneous emission coupling efficiency. Involved in the study of QD cavity QED. Involved in developing high-index-contrast air-gap III-nitride nano/micro-structures for optoelectronic and cavity QED applications; Blue-ray GaN photonic-crystal nanocavity and air-gap microcavity light-emitting diodes. Developed a tapered-fiber probing system for investigating coherent light-wave interaction in coupled resonator-waveguide systems. Experienced in UCSB Nanofabrication Facility (http://www.nanotech.ucsb.edu/)	Santa Barbara, CA 9/2004 – 9/2006

Doctoral Student*Korea Advanced Institute of Science and Technology, Physics Department*Studied the optical process of Er³⁺ in silicon photonic crystal nanostructures

Studied the photonic crystal nanolasers with InGaAs quantum dots emitting at 1.3 μm.

Experienced plane-wave expansion method and finite-difference time-domain method for calculating photonic band structure and designing nanocavities.

Developed photonic crystal processing for Er-doped Si and GaAs with InGaAs QDs.

Daejeon, Korea

3/2000 – 8/2004

Masters Student*Korea Advanced Institute of Science and Technology, Physics Department*

Studied laser cooling and trapping of alkali atoms

Studied optical process in ultrahigh-Q (~10⁹) microsphere dye lasers.

Developed a frequency stabilized diode laser system; a 30 cm-long reference cavity using ultralow-expansion material from Corning, vacuum housing, and a p-i-d circuit for electrical feedback.

Daejeon, Korea

3/1998 – 2/2000

TECHNICAL EXPERTIES**Programming:** C, Matlab, Mathematica, and LabView.**Optical characterization:** photoluminescence, liquid helium/nitrogen cryostats; time-correlated photon counting; Hanbury-Brown Twiss setup; analysis of spectral loss, polarization dependent loss, group delay, differential group delay, tapered-fiber probing.**Electrical characterization:** micro-electroluminescence, L-I-V measurements**Laser system:** Coherent ring dye laser, CO₂ laser, Nd:YAG laser, Ar-ion laser, HeCd laser, KrF laser, Frequency-stabilized tunable diode laser, and Ti:Sapphire laser.**Semiconductor processing of GaN, GaAs, Si, and InP:** electron-beam lithography, photo-lithography, nanoimprint lithography, reactive ion etching, inductively coupled plasma etching, chemically assisted ion-beam etching, electron-beam deposition, rapid thermal annealing, thermal wet oxidation, flip-chip bonding, laser lift-off, plasma-enhanced chemical vapor deposition, and thermal deposition, chemical mechanical polishing, band-gap selective photo-electro-chemical (PEC) etching; scanning electron microscopy, atomic force microscopy, and focused-ion-beam.**Electronics:** p-i-d feedback module, photo-diodes housing, photo-multiplier housing**ACADEMIC SERVICES**Reviewer for **Appl. Phys. Lett.**, **J. Appl. Phys.**, **Nature Photonics**, **IEEE Photon. Technol. Lett.** and **Jpn. J. Appl. Phys.****PATENTS**J. S. Speck, E. L. Hu, C. C. Weisbuch, **Y.-S. Choi**, G. Koblmüller, M. Iza, and C. Hurni, *Selective dry etching of N-face (Al,In,Ga)N heterostructures*, **UC Case No 2007-460-1** (March 2007).E. L. Hu, S. Nakamura, **Y.-S. Choi**, R. Sharma, and C.-F. Wang, *Ion Beam Treatment for the Structural Integrity of Air-gap III-nitride Devices produced by Photoelectrochemical (PEC) Etching*, **UC Case No. 2007-161-1** (November 2006).**PUBLICATIONS** **Since 2005:****Y.-S. Choi**, R. Sharma, S. Nakamura, and E. L. Hu, *Fabrication of air-gap III-nitride microstructures for optoelectronics*, submitted to *Appl. Phys. Lett.* (Aug 2007).R. Sharma, **Y.-S. Choi**, C. F. Wang, A. David, C. Weisbuch, S. Nakamura, and E. L. Hu, *Gallium-nitride-based microcavity light-emitting diodes with air-gap distributed Bragg reflectors*, submitted to *Appl. Phys. Lett.* (July 2007).**Y.-S. Choi**, M. Iza, E. Matioli, G. Koblmüller, J. S. Speck, C. Weisbuch, and E. L. Hu, *2.5λ microcavity InGaN light emitting diodes fabricated by a selective dry-etch thinning process*, *Appl. Phys. Lett.* **91**, 061120 (2007).

K. H. Lee, **Y.-S. Choi**, K. J. Hennessy, C.-F. Wang, E. L. Hu, J. He, P. Petroff, *Sensitive assessment of dry-etch induced sidewall roughness using microdisk resonators*, in preparation for submission.

Y.-S. Choi, M. Davanco, K. H. Lee, J. Mack, C. F. Wang, D. Blumenthal, and E. L. Hu, *Dispersive Phase Response in an Optical Waveguide-Cavity System*, Appl. Phys. Lett. **90**, 191108 (2007).

C. F. Wang, **Y.-S. Choi**, J. C. Lee, E. L. Hu, J. Yang, and J. E. Butler, *Observation of Whispering Gallery Modes in Nanocrystalline Diamond Microdisks*, Appl. Phys. Lett. **90**, 081110 (2007).

Y.-S. Choi, M. T. Rakher, K. Hennessy, S. Strauf, A. Badolato, P. M. Petroff, D. Bouwmeester, and E. L. Hu, *Evolution of the onset of coherence in a family of photonic crystal nanolasers*, Appl. Phys. Lett. **91**, 031108 (2007).

S. Strauf, K. Hennessy, M. T. Rakher, **Y.-S. Choi**, A. Badolato, L. C. Andreani, P. M. Petroff, E. L. Hu, and D. Bouwmeester, *Self-tuned quantum-dot gain in photonic crystal lasers*, Phys. Rev. Lett. **96**, 127404 (2006).

C. Meier, K. J. Hennessy, E. D. Haberer, R. Sharma, **Y.-S. Choi**, K. McGroddy, S. Keller, S. P. DenBaars, S. Nakamura, and E. L. Hu, *Visible Resonant Modes in GaN based Photonic Crystal Membrane Cavities*, Appl. Phys. Lett. **88**, 031111 (2006).

(Cover Article) Y.-S. Choi, C. Meier, K. Hennessy, R. Sharma, E. Haberer, Y. Gao, S. P. DenBaars, S. Nakamura, and E. L. Hu, *GaN Blue Photonic Crystal Membrane Nanocavities*, Appl. Phys. Lett. **87**, 243101 (2005).

Y.-S. Choi, S.-K. Kim, S.-H. Kim, H.-G. Park, Y.-H. Lee, I. N. Kaiander, F. Hopfer, R. L. Sellin, and D. Bimberg, *Lithographic Tuning of Photonic-crystal Unit-cell Resonators with InGaAs/GaAs quantum dots emitting at 1.2 μ m*, J. Vac. Sci. Technol. B. **23(1)**, 252 (2005).

2001 – 2004:

Y.-S. Choi, J.-Y. Sung, S.-H. Kim, J. H. Shin, and Y.-H. Lee, *Active Silicon-based Two-dimensional Photonic Crystal Slab Structures based on Erbium-doped Hydrogenated Amorphous Silicon alloyed with Carbon*, Appl. Phys. Lett. **83**, 3239 (2003).

S.-H. Kim, H.-Y. Ryu, H.-G. Park, G.-H. Kim, **Y.-S. Choi**, Y.-H. Lee, and J.-S. Kim, *Two-dimensional Photonic Crystal Hexagonal Waveguide Ring Laser*, Appl. Phys. Lett. **81**, 2499 (2002).

Y.-S. Choi, H.-J. Moon, S. W. Kim, and K. An, *An ultrahigh-Q microsphere laser based on the evanescent-wave-coupled gain*, <http://xxx.lanl.gov/abs/physics/0106032>.

Y.-S. Choi, H.-J. Moon, K. An, S.-B. Lee, J.-H. Lee, and J. S. Chang, *Ultrahigh-Q Microsphere Dye Laser Based on Evanescent-Wave-Coupling*, J. Kor. Phys. Soc. **39**, 928 (2001).

CONFERENCE PROCEEDINGS

M. T. Rakher, S. Strauf, **Y.-S. Choi**, N. G. Stolz, K. J. Hennessy, H. Kim, A. Badolato, L. A. Coldren, E. L. Hu, P. M. Petroff, and D. Bouwmeester, *Cavity QED with quantum dots in semiconductor microcavities*, Proc. SPIE, **6481**, 648109 (San Jose, CA, February 2007).

Y.-S. Choi, R. Sharma, J. Joo, C. Meier, S. Nakamura, E. L. Hu, *Photonic-crystal band-edge modes and enhanced light extraction in GaN photonic-crystal membrane structures*,

IWN2006 Technical digest, p.165:WeOD1-6 (Kyoto, Japan, October 2006).

K. H. Lee, C. F. Wang, **Y.-S. Choi**, K. J. Hennessy, E. L. Hu, J. He, and P. M. Petroff, Highly sensitive assessment of dry etch damage by measuring microdisk resonator Q, IEEE LEOS Annual Meeting Proceedings, PID269545 (Quebec, Canada, October 2006).

(Best paper - 3rd place) Y.-S. Choi, C. Meier, R. Sharma, K. Hennessy, E. Haberer, S. Nakamura, E. L. Hu, *Optical properties of GaN photonic crystal membrane nanocavities at blue wavelengths*, Mater. Res. Soc. Proceedings, **892**, FF20-06.1-5 (Boston, MA, Fall 2005).

Y.-S. Choi, C. Meier, R. Sharma, K. Hennessy, E. Haberer, Y. Gao, S. Nakamura, E. L. Hu, *Optical properties of GaN photonic crystal membrane nanocavities*, International Quantum Electronics Conference / the Pacific Rim Conference on Lasers and Electro-Optics 2005, CTuE2-4 (Tokyo, Japan, July 2005).

Y.-S. Choi, S.-H. Kim, J.-K. Yang, Y.-H. Lee, I. N. Kaiander, F. Hopfer, R. L. Sellin, and D. Bimberg, *Modified photonic-crystal stick resonators with self-organized InGaAs quantum dots emitting at 1.2 μ m*, The 31st International Symposium on Compound Semiconductors, Tu-1B-3 (Seoul, Korea, September 2004).

Y.-S. Choi, H.-J. Moon, and K. An, *Ultrahigh-Q microsphere laser based on the evanescent wave-coupled gain*, The 4th Pacific Rim Conference on Lasers and Electro-Optics, WG3-2 (Chiba, Japan, July 2001).

Y.-S. Choi, H.-J. Moon, and K. An, *Ultrahigh loaded Q of microsphere in the whispering-gallery-mode lasing based on the evanescent-wave-coupled gain*, The 15th International Conference on Laser Spectroscopy, P2-41 (Snowbird, Utah, June 2001).

CONFERENCES Since 2005:

(Poster) **Y.-S. Choi**, M. Davanco, C. F. Wang, K. H. Lee, D. Blumenthal, and E. L. Hu, *Phase-sensitive Optical-wave Transfer in Waveguide-Resonator Systems*, International Conference on Photonic and Electromagnetic Structure VII (Monterey, CA, April 2007).

(Poster) **Y.-S. Choi**, R. Sharma, C.-F. Wang, S. Nakamura, E. L. Hu, *Air-gap Nanostructures for Highly-efficient GaN Microcavity Emitters*, International Conference on Photonic and Electromagnetic Structure VII (Monterey, CA, April 2007).

(Invited) GaN Photonic Crystal Emitters, The 43rd Annual Workshop on Compound Semiconductor Materials and Devices (Savannah, GA, 18/February/2007).

(Talk) R. Sharma, **Y.-S. Choi**, C.-F. Wang, E. Hu, and S. Nakamura, *III-nitride air-gap microstructures for optoelectronic applications*, Materials Research Society Fall Meeting 2006, I12.10 (Boston, MA, November 2006).

(Talk) **Y.-S. Choi**, R. Sharma, J. Joo, C. Meier, S. Nakamura, E. L. Hu, *Photonic-crystal band-edge modes and enhanced light extraction in GaN photonic-crystal membrane structures*, International Workshop on Nitride semiconductors 2006, WeOD1-6 (Kyoto, Japan, October 2006).

(Talk) **Y.-S. Choi**, M. T. Rakher, K. Hennessy, S. Strauf, A. Badolato, P. M. Petroff, D. Bouwmeester, and E. L. Hu, *Laser photon statistics in high- β quantum-dot photonic-crystal nanocavities*, Conference on Lasers and Electro-Optics / Quantum Electronics and Laser Science Conference 2005, QThH2 (Long Beach, CA, May 2006).

(Talk, 3rd best paper) **Y.-S. Choi**, C. Meier, R. Sharma, K. Hennessy, E. Haberer, S. Nakamura, E. L. Hu, *Optical properties of GaN photonic crystal membrane nanocavities at blue wavelengths*, Materials Research Society Fall Meeting 2005, 0892-FF20-06.1, (Boston, MA, December 2005).

(Talk) **Y.-S. Choi**, C. Meier, R. Sharma, K. Hennessy, E. Haberer, Y. Gao, S. Nakamura, E. L. Hu, *Optical properties of GaN photonic crystal membrane nanocavities*, International Quantum Electronics Conference / the Pacific Rim Conference on Lasers and Electro-Optics 2005, CTuE2-4 (Tokyo, Japan, July 2005).

(Poster) **Y.-S. Choi**, M. T. Rakher, S. Strauf, K. Hennessy, A. Badolato, D. Bouwmeester, P. M. Petroff, and E. L. Hu, *Photon statistics of high- β quantum dot photonic-crystal lasers*, International Conference on Photonic and Electromagnetic Structure VI, A29, (Crete, Greece, June 2005).

2001 – 2004:

(Talk) **Y.-S. Choi**, S.-H. Kim, J.-K. Yang, Y.-H. Lee, I. N. Kaiander, F. Hopfer, R. L. Sellin, and D. Bimberg, *Modified photonic-crystal stick resonators with self-organized InGaAs quantum dots emitting at 1.2 μ m*, The 31st International Symposium on Compound Semiconductors, Tu-1B-3 (Seoul, Korea, September 2004).

(Poster) **Y.-S. Choi**, S.-K. Kim, S.-H. Kim, H.-G. Park, Y.-H. Lee, I. Kaiander, and D. Bimberg, *High- Q photonic-crystal nanocavity with self-assembled InGaAs quantum dots*, International Conference on Photonic and Electromagnetic Structure V, Th-P41 (Kyoto, Japan, March 2004).

(Talk) **Y.-S. Choi**, G. K. Mebratu, Y. H. Lee, and J. H. Shin, *Active, Si-based Photonic Bandgap and Microphotonic Structures based on Rare Earth doped Hydrogenated Amorphous Si Alloyed with Carbon*, Material Research Society Spring Meeting, I5.6 (San Francisco, CA, April 2003).

(Talk) J.-Y. Sung, **Y.-S. Choi**, S.-H. Kim, J. H. Shin, and Y.-H. Lee, *Active Si-based Photonic Crystal Devices using Erbium-doped Si/SiO₂ Superlattices*, Material Research Society Fall Meeting 2002, O3.2 (Boston, MA, December 2002).

(Talk) **Y.-S. Choi**, H.-J. Moon, and K. An, *Ultrahigh- Q microsphere laser based on the evanescent wave-coupled gain*, The 4th Pacific Rim Conference on Lasers and Electro-Optics, WG3-2 (Chiba, Japan, July 2001).

(Poster) **Y.-S. Choi**, H.-J. Moon, and K. An, *Ultrahigh loaded Q of microsphere in the whispering-gallery-mode lasing based on the evanescent-wave-coupled gain*, The 15th International Conference on Laser Spectroscopy, P2-41 (Snowbird, Utah, June 2001).

References

Prof. Evelyn L. Hu

hu@ece.ucsb.edu

Tel: +1-805-893-2368

Fax: +1-805-893-6132

ECE and Materials Department
California NanoSystems Institute
University of California
Santa Barbara CA 93106-6105

Prof. James S. Speck

speck@mrl.ucsb.edu

Tel: +1-805-893-8005

Fax: +1-805-893-8983

Materials Department
University of California
Santa Barbara CA 93106-5050

Prof. Claude Weisbuch

claude.weisbuch@polytechnique.fr

Tel (polytechnique):

(33) (0)1 6933 3959

Mobile (worldwide):

(33) (0)6 8293 2521

Materials Department
University of California
Santa Barbara CA 93106-5050

Prof. Shuji Nakamura

shuji@engineering.ucsb.edu

Tel: +1-805-893-5552

Fax: +1-805-893-8983

Materials Department
Bldg. 503, Rm. 1355
University of California
Santa Barbara CA 93106-5050

Prof. Dirk Bouwmeester

bouwmeester@physics.ucsb.edu

Tel: +1-805-893-8358

Fax: +1-805-893-3307

Department of Physics
Broida Hall, Rm. 4123
University of California
Santa Barbara CA 93106-9530

Prof. Yong-Hee Lee

yhlee@kaist.ac.kr

Tel: +82-42-869-2536

Fax: +82-42-869-2510

Department of Physics
Korea Advanced Institute of Science
and Technology
Natural Science Building
373-1 Gusungdong Yusung
Daejeon, 305-701, Korea