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April 28, 2016

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Major professional interests

Random lasers, mesoscopic transport of photons, semiconductor microcavity lasers, UV photonic crystal light sources.

Education

Ph.D.	Stanford University	1997
	Major: Applied Physics. Minor: Electrical Engineering	
M.A.	Princeton University	1992
	Mechanical & Aerospace Engineering	
B.S.	Peking University	1990
	Physics	

Predoctoral awards and fellowships

Karel Urbanek Graduate Fellowship	1997
Zonta International Foundation Amelia Earhart Fellowship	1992
Grumman Graduate Prize	1991
Guang-Hua Fellowship	1989

Postdoctoral recognitions

Microscopy Today Innovation Award for Speckle-free semiconductor laser	2016
William E. Lamb Medal for Laser Physics and Quantum Optics	2015
Microscopy Today Innovation Award for On-chip Random Spectrometer	2014
Member, Connecticut Academy of Science & Engineering	2014
John Simon Guggenheim Fellowship	2013
APS DLS Distinguished Traveling Lecturer	2008
Fellow of American Physical Society	2007
Fellow of Optical Society of America	2007
Maria Goeppert-Mayer Award from American Physical Society	2006
Friedrich Wilhelm Bessel Research Award from Alexander von Humboldt Foundation	2005
Outstanding Young Researcher Award from Overseas Chinese Physics Association	2004
National Science Foundation CAREER Award	2001
Alfred P. Sloan Fellow	2000
David and Lucile Packard Fellow	1999

Employment

Professor of Applied Physics and of Physics Yale University	Jan. 2008 – Present
Professor of Physics Northwestern University	Sept. 2007 – Dec. 2007
Associate Professor of Physics	Sept. 2002 – Aug. 2007

Patent

- S. Pau, H. Cao, Y. Yamamoto, “Exciton Polariton Light Emitting Diode”, US Patent No. 5,877,509, 1999.
- A. D. Stone, Y. D. Chong, H. Cao, and L. Ge. “Controlling absorption of light in a cavity”. US Patent No. 9,041,996, 2015.
- H. Cao, B. Redding, and M. Choma. “Systems and Methods for Imaging Using a Random Laser”. US Patent pending.
- H. Cao, A. D. Stone, M. A. Choma, M. L. Lee, B. Redding, X. Huang, A. Cerjan. “Low spatial coherence semiconductor chaotic cavity laser”. US Patent pending.

Book and book chapters

1. Y. Yamamoto, F. Tassone, and H. Cao, “Semiconductor Cavity Quantum Electronics”, Springer-Verlag, 2000.
2. H. Cao, “Random Lasers with Coherent Feedback”, in “Photonic crystals and light localization in the 21st century”, ed. C. M. Soukoulis, Springer, 389-404 (2001)
3. H. Cao, “Random Lasers with Coherent Feedback”, in “Optical Properties of Nanostructured Random Media”, ed. V. M. Shalaev, Springer, 303-328 (2002).
4. H. Cao, “Lasing in Disordered Media”, in “Progress in Optics”, ed. E. Wolf, North-Holland, vol. 45, 317-370 (2003).
5. H. Cao, “Lasing in Random Media,” Chap. 11 in “Tutorials in Complex Photonic Media”, ed. M. A. Noginov, M. W. McCall, G. Dewar, and N. I. Zheludev, Eds., SPIE Press, Bellingham, WA, 301–358 (2009).
6. J. Wiersig, J. Unterhinninghofen, Q. Song, H. Cao, M. Hentschel, S. Shinohara, *Review on unidirectional light emission from ultralow-loss modes in deformed microdisks*, Chapter 4 in “Trends in Nano- and Micro-Cavities,” ed. O’Dae Kwon, Byoungcho Lee, Kyungwon An, Bentham Science Publisher Ltd., pp. 109-152 (2010).
7. J. Wiersig, J. Unterhinninghofen, Q. Song, H. Cao, M. Hentschel, S. Shinohara, “Review on unidirectional light emission from ultralow-loss modes in deformed microdisks”, Chapter 4 in “Trends in Nano- and Micro-Cavities”, ed. O’Dae Kwon, Byoungcho Lee, Kyungwon An, Bentham Science Publisher Ltd., pp. 109-152 (2011).
8. H. Cao, “Lasing in Random Media”, Chapter 12 in “Optical Processes in Microparticles and Nanostructures”, ed. A. Serpenguzel and A. W. Poon, World Scientific, Advanced Series in Applied Physics Vol. 6, pp. 205-251 (2011).
9. H. Cao and R. P. H. Chang, “Novel Applications of ZnO: Random lasing and UV Photonic Light Sources”, Chapter 5 in “Handbook of Luminescent Semiconductor Materials”, ed. L. Bergman and J. L. McHale, CRC Press, Taylor & Francis Group, pp. 125-143 (2012).
10. A. Yamilov and H. Cao, “Self-Optimization of Optical Confinement and Lasing Action in Disordered Photonic Crystals”, in “Optical properties of photonic structures: interplay of order and disorder”, ed. M. F. Limonov and R. De La Rue, CRC Press, series in optics and optoelectronics, Taylor & Francis Group (2012).
11. J.-B. Shim, A. Eberspacher, J. Wiersig, J. Unterhinninghofen, Q. H. Song, L. Ge, H. Cao and A. D. Stone, “Deformed wavelength-scale microdisk lasers with quantum dot emitters”, Chapter 7 in “Quantum optics with semiconductor nanostructures”, ed. F. Jahnke, Woodhead Publishing Limited, series in Electronic and Optical Materials: No. 28, pp. 225-252 (2012).

12. H. Cao and H. Noh, "Lasing in Amorphous Nanophotonic Structures", Chap. 9 in "Amorphous Nanophotonics". Ed. Carsten Rockstuhl and Toralf Scharf, Springer Berlin Heidelberg, pp. 227-265 (2013).

Review articles

1. H. Cao, "Lasing in Random Media", *Waves in Random Media*, vol. 13, pp. R1-R39, June 2003.
2. H. Cao, "Review on Latest developments in random lasers with coherent feedback", *J. Phys. A: Math. Gen.*, vol. 38, pp. 10497-10535, Nov. 2005.
3. J. Andreasen, A. A. Asatryan, L. C. Botten, M. A. Byrne, H. Cao, L. Ge, L. Labonté, P. Sebbah, A. D. Stone, H. E. Türeci, and C. Vanneste, "Modes of random lasers", *Advances in Optics and Photonics*, vol. 3, pp. 88-127, Oct. 2010.
4. J. Andreasen, N. Bachelard, S. B. N. Bhaktha, H. Cao, P. Sebbah, and C. Vanneste, "Partially Pumped Random Lasers", *Int. J. Mod. Phys. B*, vol. 28, 1430001, Jan. 2014.
5. H. Cao, and J. Wiersig, "Dielectric microcavities: model systems for wave chaos and non-Hermitian physics", *Rev. Mod. Phys.* vol. 87, pp. 61-111, Jan. 2015.

Journal papers

1. C. Q. Cao, H. Cao, "The Effect of Dissipation of Plasmas on Spontaneous Radiation Intensity of Ionized Atom", *J. Phys. B*, vol. 26, p. 3959-3973, Nov. 1993.
2. H. Cao, D. DiCicco, S. Suckewer, "Quenching A-coefficient by Photons in a Short Discharge Tube", *J. Phys. B*, vol. 26, p. 4057-4064, Nov. 1993.
3. H. Cao, J. M. Jacobson, G. Björk, S. Pau and Y. Yamamoto, "Observation of Dressed-Exciton Oscillating Emission over a Wide Wavelength Range in a Semiconductor Microcavity", *Appl. Phys. Lett.*, vol. 66, p. 1107-1109, Feb. 1995.
4. J. M. Jacobson, H. Cao, S. Pau, G. Björk and Y. Yamamoto, "Observation of Exciton-Polariton Oscillating Emission in a Semiconductor Microcavity", *Phys. Rev. A*, vol. 51, p. 2542-2544, Mar. 1995.
5. S. Pau, G. Björk, J. Jacobson, H. Cao and Y. Yamamoto, "Stimulated Emission of Microcavity Dressed Exciton and Suppression of Phonon Scattering", *Phys. Rev. B*, vol. 51, p. 7090-7100, Mar. 1995.
6. H. Cao, and C. Q. Cao, "Spontaneous Radiation by a three-level atom in a dissipative medium", *J. Phys. B.*, vol. 28, p. 979-988, Mar. 1995.
7. S. Pau, G. Björk, J. M. Jacobson, H. Cao, and Y. Yamamoto, "Microcavity Exciton Polariton Splitting in the Linear Regime", *Phys. Rev. B*, vol. 51, p. 14437-14447, May 1995.
8. H. Cao, G. Klimovitch, G. Björk and Y. Yamamoto, "Direct creation of excitons in a quantum well by electron resonant tunneling", *Phys. Rev. Lett.*, vol. 75, p. 1146-1149, Aug. 1995.
9. H. Cao, G. Klimovitch, G. Björk, and Y. Yamamoto, "Theory of direct creation of quantum-well excitons by hole-assisted electron resonant tunneling", *Phys. Rev. B*, vol. 52, p. 12184-12190, Oct. 1995.
10. G. Björk, S. Pau, J. M. Jacobson, H. Cao and Y. Yamamoto, "Excitonic Superradiance to Exciton-polariton Crossover and the Pole Approximation", *Phys. Rev. B*, vol. 52, p. 17310-17320, Dec. 1995.
11. C. Q. Cao, H. Cao, and W. Long, "Multipole Radiation in an Inhomogeneous Dispersive Medium with Spherical Symmetry", *J. Phys. B.*, vol. 28, p. 5343-5357, Dec. 1995.
12. G. Björk, S. Pau, J. M. Jacobson, H. Cao and Y. Yamamoto, "Effect of Dephasing on Excitonic Superradiance and Exciton Cavity Polaritons", *J. Opt. Soc. Am. B*, vol. 13, p. 1069-1077, May 1996.

13. S. Pau, G. Björk, H. Cao, E. Hanamura, and Y. Yamamoto, "Theory of Inhomogeneous Microcavity Polariton Splitting", *Solid State Commun.*, vol. 98, p. 781-784, June 1996.
14. H. Cao, S. Pau, Y. Yamamoto, and G. Björk, "Exciton-Polariton Ladder in a Semiconductor Microcavity", *Phys. Rev. B.*, vol. 54, p. 8083-8086, Sept. 1996.
15. S. Pau, H. Cao, J. Jacobson, G. Björk, and Y. Yamamoto, "Observation of Laser-Like Transition in Microcavity Exciton Polariton System", *Phys. Rev. A.*, vol. 54, R1789-1792, Sept. 1996.
16. S. Pau, G. Björk, H. Cao, R. Huang and Y. Yamamoto, "LO Phonon enhanced Microcavity Polariton Emission", *Phys. Rev. B*, vol. 55, p. R1942-1945, Jan. 1997.
17. C. Q. Cao, H. Cao, and K. Qin, "Modification of Einstein A Coefficient in Dissipative Gas Medium", *Phys. Lett. A*, vol. 226, p. 135-142, Feb. 1997.
18. G. Klimovitch, G. Björk, H. Cao and Y. Yamamoto, "Selective Resonant Tunneling into Micro Cavity Exciton-Polariton State", *Phys. Rev. B.*, vol. 55, p. 7078-7083, Mar. 1997.
19. H. Cao, G. Klimovitch, G. Björk and Y. Yamamoto, "Tunneling Spectroscopy for Quantum Well Excitons", *Appl. Phys. Lett.*, vol. 70, p. 1986-1988, Apr. 1997.
20. H. Cao, S. Pau, J. M. Jacobson, G. Björk, Y. Yamamoto, and A. Imamoglu, "Transition from a Microcavity Exciton Polariton to a Photon Laser", *Phys. Rev. A*, vol. 55, p. 4632-4635, June 1997.
21. C. Q. Cao, W. Long, and H. Cao, "The Local Field Correction Factor for Spontaneous Emission", *Phys. Lett. A*, vol. 232, p. 15-24, July 1997.
22. H. Cao, S. Jiang, S. Machida, Y. Takiguchi, Y. Yamamoto, "Collapse and Revival of Exciton-Polariton Oscillation in a Semiconductor Microcavity", *Appl. Phys. Lett.*, vol. 71, p. 1461-1463, Sept. 1997.
23. R. Huang, H. Cao, Y. Yamamoto, "Measurement of the Intensity and Phase of Microcavity Exciton-Polariton Emission in the Linear and Nonlinear Regimes", *Phys. Rev. B*, vol. 56, p. 9217-9220, Oct. 1997.
24. S. Jiang, S. Machida, Y. Takiguchi, H. Cao, and Y. Yamamoto, "Wide band AC balanced homodyne detection of weak coherent pulses", *Opt. Commun.*, vol. 145, p. 91-94, Jan. 1998.
25. H. Cao, J. Y. Wu, H. C. Ong, J. Y. Dai, and R. P. H. Chang, "Second Harmonic Generation in Laser Ablated Zinc Oxide Thin Films", *Appl. Phys. Lett.*, vol. 73, p. 572-574, Aug. 1998.
26. S. Jiang, S. Machida, Y. Takiguchi, Y. Yamamoto, and H. Cao, "Direct time-domain observation of transition from strong to weak coupling in a semiconductor microcavity", *Appl. Phys. Lett.*, vol. 73, p. 3031-3033, Nov. 1998.
27. H. Cao, Y. G. Zhao, H. C. Ong, S. T. Ho, J. Y. Dai, J. Y. Wu, and R. P. H. Chang, "Ultraviolet Lasing in Resonators Formed by Scattering in Semiconductor Polycrystalline Films", *Appl. Phys. Lett.*, vol. 73, p. 3656-3658, Dec. 1998.
28. H. Cao, Y. Zhao, S. T. Ho, E. W. Seelig, Q. H. Wang, R. P. H. Chang, "Random Laser Action in Semiconductor Powder", *Phys. Rev. Lett.*, vol. 82, p. 2278-2281, Mar. 1999.
29. Y. Zhao, W. Han, J. Song, X. Li, Y. Liu, D. Gao, G. Du, H. Cao, and R. P. H. Chang, "Spontaneous Emission Factor for Semiconductor Superluminescent Diodes", *J. Appl. Phys.*, vol. 85, p. 3945-3948, Apr. 1999.
30. H. Cao, Y. G. Zhao, H. C. Ong, and R. P. H. Chang, "Far-field Characteristics of Random Lasers", *Phys. Rev. B*, vol. 59, p. 15107-15111, June 1999.
31. C. Q. Cao, and H. Cao, "Line Profile and Additional Broadening in a Dissipative Medium", *J. Opt. B: Quantum Semiclass Opt.*, vol. 1, p. 325-331, June 1999.
32. H. Cao, Y. G. Zhao, X. Liu, E. W. Seelig, R. P. H. Chang, "Effect of External Feedback on Lasing in Random Media", *Appl. Phys. Lett.*, vol. 75, p. 1213-1215, Aug. 1999.

33. S. Jiang, S. Machida, Y. Takiguchi, Y. Yamamoto, and H. Cao, “Direct Time Domain Observation of Exciton-Polariton Oscillation in a Semiconductor Microcavity”, *Superlattices and Microstructures*, vol. 26, p. 73-82, Aug. 1999.
34. H. Cao, D. B. Hall, J. M. Torkelson, and C. Q. Cao, “Large Enhancement of Second Harmonic Generation in Polymer Films by Microcavities”, *Appl. Phys. Lett.*, vol. 76, p. 538-540, Jan. 2000.
35. H. Cao, J. Y. Xu, S.-H. Chang, and S. T. Ho, “Transition from Amplified Spontaneous Emission to Laser Action in Strongly Scattering Media”, *Phys. Rev. E.*, vol. 61, p. 1985-1989, Feb. 2000.
36. Y. X. Liu, C. Q. Cao, H. Cao, “Effect of the exciton-exciton interaction on resonance fluorescence of excitons in a quantum well”, *Phys. Rev. A.*, vol. 61, p. 23,802-23,808, Feb. 2000.
37. G. Klimovitch, F. Tassone, Y. Yamamoto, and H. Cao, “Stimulated Resonant Tunneling into Quantum Well Excitons”, *Phys. Lett. A*, vol. 267, p. 281-286, Mar. 2000.
38. H. Cao, J. Y. Xu, E. W. Seelig, and R. P. H. Chang, “Microlasers Made of Disordered Media”, *Appl. Phys. Lett.*, vol. 76, p. 2997-2999, May 2000.
39. H. Cao, J. Y. Xu, S.-H. Chang, S. T. Ho, E. W. Seelig, X. Liu, and R. P. H. Chang, “Spatial Confinement of Laser Light in Active Random Media”, *Phys. Rev. Lett.*, vol. 84, p. 5584-5587, June 2000.
40. H. Cao, J. Y. Xu, W. H. Xiang, Y. Ma, S.-H. Chang, S. T. Ho, and G. S. Solomon, “Optically Pumped InAs Quantum Dot Microdisk Lasers”, *Appl. Phys. Lett.*, vol. 76, p. 3519-3521, June 2000.
41. G. T. Kiehne, M. Z. Lin, G. Wang, W. H. Xiang, H. Cao, J. B. Ketterson, “A pulser for Medium-Frequency Modulated Direct-current Reactive Sputter Deposition of Insulators”, *Rev. Sci. Instrum.*, vol. 71, p. 2560-2562, June 2000.
42. K. J. Luo, J. Y. Xu, H. Cao, Y. Ma, S. H. Chang, S. T. Ho, and G. S. Solomon, “Dynamics of GaAs/AlGaAs Microdisk Lasers”, *Appl. Phys. Lett.*, vol. 77, p. 2304-2306, Oct. 2000.
43. C. Q. Cao, H. Cao, Y. X. Liu, “Quantum statistical theory of fluorescence of low density Frenkel excitons in a crystal slab”, *Phys. Rev. B*, vol. 62, p. 16453-16473, Dec. 2000.
44. H. Cao, Y. Ling, J. Y. Xu, C. Q. Cao, and P. Kumar, “Photon Statistics of Random Lasers with Resonant Feedback”, *Phys. Rev. Lett.*, vol. 86, p. 4524-4527, May 2001.
45. K. J. Luo, J. Y. Xu, H. Cao, Y. Ma, S. H. Chang, S. T. Ho, and G. S. Solomon, “Ultrafast dynamics of InAs/GaAs quantum-dot microdisk lasers”, *Appl. Phys. Lett.*, vol. 78, pp. 3397-3399, May 2001.
46. Y. Jin, B. Zhang, S. Yang, Y. Wang, J. Chen, H. Zhang, C. Huang, C. Q. Cao, H. Cao, R. P. H. Chang, “Room temperature UV emission of MgZnO films”, *Solid State Commun.*, vol. 119, pp. 409-413, July 2001.
47. C. Q. Cao, W. Long, J. K. Wei, and H. Cao, “Non-Markovian Correlation Spectra and Quantum Stochastic Trajectory Analysis of Spontaneous Emission of an Excited Two-Level Atom”, *Phys. Rev. A*, vol. 64, pp. 43810, Oct. 2001.
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51. C. M. Soukoulis, X. Jiang, J. Y. Xu, and H. Cao, “Dynamic response and relaxation oscillation in random lasers”, *Phys. Rev. B*, vol. 65, R41103, Jan. 2002.
52. A. L. Burin, M. A. Ratner, H. Cao, and S.-H. Chang, “Random laser in one dimension”, *Phys. Rev. Lett.*, vol. 88, 093904, Feb. 2002.

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