



Steven Chu



Date of Birth 28 February 1948

Place St Louis, Missouri (USA)

Nomination 30 January 2018

Field Physics

Title Professor of Physics and Molecular & Cellular Physiology; William R. Kenan, Jr., Professor of Humanities and Sciences; 1997 Nobel Prize in Physics

Most important awards, prizes and academies

Steven Chu is the William R. Kenan, Jr., Professor of Physics and Professor of Molecular & Cellular Physiology in the Medical School at Stanford University. He was the 12th U.S. Secretary of Energy from January 2009 until the end of April 2013. As the first scientist to hold a Cabinet position and the longest serving Energy Secretary, he recruited outstanding scientists and engineers into the Department of Energy. He began several initiatives including ARPA-E (Advanced Research Projects Agency – Energy), the Energy Innovation Hubs, and was personally tasked by President Obama to assist BP in stopping the Deepwater Horizon oil leak.

Prior to his cabinet post, he was director of the Lawrence Berkeley National Laboratory, where he was active in pursuit of alternative and renewable energy technologies, and Professor of Physics and Applied Physics at Stanford University, where he helped launch Bio-X, a multi-disciplinary institute combining the physical and biological sciences with medicine and engineering. Previously he was head of the Quantum Electronics Research Department at AT&T Bell Laboratories.

Dr. Chu is the co-recipient of the 1997 Nobel Prize in Physics for his contributions to laser cooling and atom trapping, and has received numerous other awards. He is a member of the National Academy of Sciences, the American Philosophical Society, the American Academy of Arts and Sciences, the Academia Sinica, and is a foreign member of the Royal Society, the Royal Academy of Engineering, the Chinese Academy of Sciences, the Korean Academy of Sciences and Technology and the National Academy of Sciences, Belarus. He is the President Elect of the American Association for the Advancement of Science. He received an A.B. degree in mathematics and a B.S. degree in physics from the University of Rochester, and a Ph.D. in physics from the University of California, Berkeley, as well as 32 honorary degrees. Dr Chu is also a Member of Bio-X, Member of the Stanford Neurosciences Institute and Member of the Siemens Science Innovation and Technology Council (2015 - Present). Honors and awards include: Co-winner in Physics, Nobel Prize (1997); Pioneer Award, Fitzpatrick Institute for Photonics, Duke Univ. (2018); Foreign Member, National Academy of Sciences of Belarus (2017); Richard Ernst Medal, ETH Zurich (2015); Robert Fletcher Award, Thayer School of Engineering, Dartmouth (2015); Fellow, National Academy of Inventors (2014); Foreign Member, Royal Society (2013); George Eastman Medal, University of Rochester (2013); Franklin Founder Award (2012); Alumnus of the Year, University of California-Berkeley (2011); Foreign Member, Royal Academy of Engineering (2011); Hans Bethe Award, Federation of American Scientists (2011); Harold Berger Award, Penn School of Engineering and Applied Science (2011); Arthur L. Schawlow Award, Laser Institute of America (2010); Honorary Fellow, Institute of Physics (2009); Hutchinson Medal for Distinguished Public Service, University of Rochester (2009); Honorary Lifetime Member, Optical Society of America (2004); Foreign Member, Korean Academy of Sciences and Technology (1998); Foreign Member, Chinese Academy of Sciences (1998); Member, American Philosophical Society (1998); Science for Art Prize, Moët Hennessey-Louis Vuitton (LVMH) (1995); Senior Scientist Award, Humboldt Foundation (1995); Distinguished Traveling Lecturer, Am. Phys. Soc. Division of Laser Science (1994-1996); Academician, Academia Sinica (1994); Arthur Schawlow Prize for Laser Science, American Physical Society (1994); William Meggers Award for Spectroscopy, Optical Society of America (1994); Co-winner, King Faisal International Prize for Science (1993); Member, National Academy of Sciences (1993); Member, American Academy of Arts and Sciences (1992); Fellow, Optical Society of

America (1990); Richtmyer Memorial Prize Lecturer, Am. Phys. Soc./Am Assoc. Physics Teachers (1990); Broida Prize for Laser Spectroscopy, American Physical Society (1987); Fellow, American Physical Society (1987); Guggenheim Fellowship, John Simon Guggenheim Foundation (1996); 32 Honorary Degrees, Various universities, colleges and institutions (till present time).

Summary of scientific research

Synthesis, functionalization and applications of nanoparticle bioprobes for molecular cellular in vivo imaging in biology and biomedicine. Linear and nonlinear difference frequency mixing ultrasound imaging. Lithium metal-sulfur batteries, new approaches to electrochemical splitting of water. CO₂ reduction, lithium extraction from salt water.

Main publications

Steven Chu has published over 280 papers in atomic and polymer physics, biophysics, biology, batteries, and other energy technologies. He holds 15 patents, and an additional 8 patent disclosures or filings since 2015. His most recent publications include: Strongly Cavity-Enhanced Spontaneous Emission from Silicon-Vacancy Centers in Diamond, *Nano Letters*, Zhang, J.L., Sun, S., Burek, M.J., Dory, C., Tzeng, Y., Fischer, K.A., Kelaita, Y., Lagoudakis, K.G., Radulaski, M., Shen, Z., Melosh, N.A., Chu, S., Lonc#ar, M., Vuc#kovi#, J. 2018; 18: 1360-1365; Vertical-Substrate MPCVD Epitaxial Nanodiamond Growth, *Nano letters*, Tzeng, Y., Zhang, J.L., Lu, H., Ishiwata, H., Dahl, J., Carlson, R.M., Yan, H., Schreiner, P.R., Vuckovic, J., Shen, Z., Melosh, N., Chu, S. 2017; The path towards sustainable energy, *Nature Materials*, Chu, S., Cui, Y., Liu, N. 2017; 16 (1): 16-22; Atomic structure of sensitive battery materials and interfaces revealed by cryo-electron microscopy, *Science*, Li, Y., Li, Y., Pei, A., Yan, K., Sun, Y., Wu, C., Joubert, L.M., Chin, R., Koh, A.L., Yu, Y., Perrino, J., Butz, B., Chu, S., Cui, Y. 2017; 358: 506-510; Complete Coherent Control of Silicon-Vacancies in Diamond Nanopillars Containing Single Defect Centers, *Optica*, Zhang, J.L., Lagoudakis, K.G., Tzeng, Y., Dory, C., Radulaski, M., Kelaita, Y., Fischer, K.A., Shen, Z., Melosh, N.A., Chu, S., Vu#kovi#, J. 2017; 4: 1317-1321; A half-wave rectified alternating current electrochemical method for uranium extraction from seawater, *Nature Energy*, Liu, C., Hsu, P., Xie, J., Zhao, J., Wu, T., Wang, H., Liu, W., Zhang, J., Chu, S., Cui, Y. 2017; 2: 17007; Speckle-modulating optical coherence tomography in living mice and humans, *Nature Communications*, Liba, O., Lew, M.D., SoRelle, E.D., Dutta, R., Sen, D., Moshfeghi, D.M., Chu, S., de la Zerda, A. 2017; 8: 15845; High-Performance Lithium Metal Negative Electrode with a Soft and Flowable Polymer Coating, *ACS Energy Letters*, Zheng, G., Wang, C., Pei, A., Lopez, J., Shi, F., Chen, Z., Sendek, A.D., Lee, H., Lu, Z., Schneider, H., Safont-Sempere, M.M., Chu, S., Bao, Z., Cui, Y. 2016 1 (6): 1247-1255; Evaluation of a Silicon Sr-90 Betavoltaic Power Source *Scientific Reports*, Dixon, J., Rajan, A., Bohlemann, S., Coso, D., Upadhyaya, A.D., Rohatgi, A., Chu, S., Majumdar, A., Yee, S. 2016; 6 Wafer-Size and Single-Crystal MoSe₂ Atomically Thin Films Grown on GaN Substrate for Light Emission and Harvesting, *ACS Applied Materials & Interfaces*, Chen, Z., Liu, H., Chen, X., Chu, G., Chu, S., Zhang, H. 2016; 8 (31): 20267-20273; Enhancing Quantum Yield via Local Symmetry Distortion in Lanthanide-Based Upconverting Nanoparticles, *ACS Photonics*, Wisser, M.D., Fischer, S., Maurer, P.C., Bronstein, N.D., Chu, S., Alivisatos, A.P., Salleo, A., Dionne, J.A. 2016; 3 (8): 1523-1530; Nanofiber Air Filters with High-Temperature Stability for Efficient PM_{2.5} Removal from the Pollution Sources, *Nano Letters*, Zhang, R., Liu, C., Hsu, P., Zhang, C., Liu, N., Zhang, J., Lee, H.R., Lu, Y., Qiu, Y., Chu, S., Cui, Y. 2016; 16 (6): 3642-3649; Selective deposition and stable encapsulation of lithium through heterogeneous seeded growth, *Nature Energy*, Yan, K., Lu, Z., Lee, H., Xiong, F., Hsu, P., Li, Y., Zhao, J., Chu, S., Cui, Y. 2016; 1; Shelterin Protects Chromosome Ends by Compacting Telomeric Chromatin, *Cell*, Bandaria, J.N., Qin, P., Berk, V., Chu, S., Yildiz, A. 2016; 164 (4): 735-746; DOI: 10.1038/srep38182, *Evaluation of a Silicon 90Sr Betavoltaic Power Source*, Dixon, J., et al., 2016; 6; Ras-GTP dimers activate the Mitogen-Activated Protein Kinase (MAPK) pathway, *Proceedings of the National Academy of Sciences of the United States of America*, Nan, X., Tamgueney, T.M., Collisson, E.A., Lin, L., Pitt, C., Galeas, J., Lewis, S., Gray, J.W., McCormick, F., Chu, S. 2015; 112 (26): 7996-8001; Polymer Nanofiber-Guided Uniform Lithium Deposition for Battery Electrodes, *Nano Letters*, Liang, Z., Zheng, G., Liu, C., Liu, N., Li, W., Yan, K., Yao, H., Hsu, P., Chu, S., Cui, Y. 2015; 15 (5): 2910-2916; Artificial Graphene and Related Photonic Lattices Generated With a Simple Method, *IEEE Photonics Journal*, Gao, Y., Song, D., Chu, S., Chen, Z. 2014; 6 (6); Ultrathin Two-Dimensional Atomic Crystals as Stable Interfacial Layer for Improvement of Lithium Metal Anode, *Nano Letters*, Yan, K., Lee, H., Gao, T., Zheng, G., Yao, H., Wang, H., Lu, Z., Zhou, Y., Liang, Z., Liu, Z., Chu, S., Cui, Y. 2014; 14 (10): 6016-6022; Interconnected hollow carbon nanospheres for stable lithium metal anodes. *Nature nanotechnology*, Zheng, G., Lee, S. 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Kim, H.D., Chu, S., Puglisi, J.D. 2004; 11 (10): 1008-1014; Precision Feshbach spectroscopy of ultracold Cs-2, *Physical Review A*, Chin, C., Vuletic, V., Kerman, A.J., Chu, S., Tiesinga, E., Leo, P.J., Williams, C. J. 2004; 70 (3); tRNA dynamics on the ribosome during translation, *Proceedings of the National Academy of Sciences of the United States of America*, Blanchard, S.C., Kim, H.D., Gonzalez, R.L., Puglisi, J.D., Chu, S. 2004; 101 (35): 12893-12898; Risk factors for proximal humerus fracture, *American Journal of Epidemiology*, Chu, S.P., Kelsey, J.L., Keegan, T.H., Sternfeld, B., Prill, M., Quesenberry, C.P., Sidney, S. 2004; 160 (4): 360-367; Magnetic properties of Sm(Co_{0.91}Fe_{0.09})_{1-x} alloys and their melt-spun materials (x=0.02-0.04, z=7.5-12) *IEEE Transactions on Magnetics*, Huang, M.Q., Turgut, Z., Smith, B.R., Chen, Z.M., Ma, B.M., Chu, S.Y., Laughlin, D.E., Horwath, J.C., Fingers, R.T. 2004; 40 (4): 2934-2936; Single-molecule studies of SNARE complex assembly reveal parallel and antiparallel configurations, *Proceedings of the National Academy of Sciences of the United States of America*, Weninger, K., Bowen, M.E., Chu, S., Brunger, A.T. 2003; 100 (25): 14800-14805; Observation of polymer conformation hysteresis in extensional flow, *Science*, Schroeder, C.M., Babcock, H.P., Shaqfeh, E.S., Chu, S. 2003; 301 (5639): 1515-1519; Visualization of molecular fluctuations near the critical point of the coil-stretch transition in polymer elongation, *Macromolecules*, Babcock, H.P., Teixeira, R.E., Hur, J.S., Shaqfeh, E.S., Chu, S. 2003; 36 (12): 4544-4548; Exploration of the transition state for tertiary structure formation between an RNA helix and a large structured RNA, *Journal of Molecular Biology*, Bartley, L.E., Zhuang, X.W., Das, R., Chu, S., Herschlag, D. 2003; 328 (5): 1011-1026; Biology and polymer physics at the single-molecule level, *Meeting on Slow Dynamics in Soft Matter*, Chu, S., Royal Soc. 2003: 689-98; Sensitive detection of cold cesium molecules formed on Feshbach resonances, *Physical Review Letters*, Chin, C., Kerman, A.J., Vuletic, V., Chu, S. 2003; 90 (3); Early steps of supported bilayer formation probed by single vesicle fluorescence assays, *Biophysical Journal*, Johnson, J.M., Ha, T., Chu, S., Boxer, S.G. 2002; 83 (6): 3371-3379; Dynamics and configurational fluctuations of single DNA molecules in linear mixed flows, *Physical Review E*, Hur, J.S., Shaqfeh, E.S., Babcock, H.P., Chu, S. 2002; 66 (1); Correlating structural dynamics and function in single ribozyme molecules, *Science*, Zhuang, X.W., Kim, H., Pereira, M.J., Babcock, H.P., Walter, N.G., Chu, S. 2002; 296 (5572): 1473-1476; Mg²⁺-dependent conformational change of RNA studied by fluorescence correlation and FRET on immobilized single molecules, *Proceedings of the National Academy of Sciences of the United States of America*, Kim, H.D., Nienhaus, G.U., Ha, T., Orr, J.W., Williamson, J.R., Chu, S. 2002; 99 (7): 4284-4289.