# Prof. Robert Eric Betzig
# Nobel laureate in Chemistry, 2014

### Most important prizes, awards and academies

1992 William L. McMillan Award; 1993 National Academy of Sciences Award for Initiatives in Research; 2014 Nobel Prize in Chemistry; 2015 Honorary Fellow, Royal Society of Chemistry; 2015 Member, National Academy of Sciences; 2015 Newcomb Cleveland Prize.

### Summary of scientific research

Near-field optics and application to biology, data storage, and semi-conductor spectroscopy. Developed superresolution method based on multidimensional localization. Developed optical lattice microscopy, photoactivated localization microscopy.

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### Main publications

E. Betzig, “Experiments on the linear and non-linear evolution of the double helical instability in jets”, Proc. of the 19th Annual Meeting of the American Institute of Aeronautics and Astronautics (1981); E. Betzig, A. Lewis, A. Harootunian, M. Isaacson, and E. Kratschmer, “Near-field scanning optical microscopy (NSOM): development and biophysical applications”, Biophys. J. 49, 269 (1986); E. Betzig, A. Harootunian, A. Lewis, and M. Isaacson, “Near-field diffraction by a slit: implications for superresolution microscopy”, Appl. Opt. 25, 1890 (1986); A. Harootunian, E.

Betzig, M. Isaacson, and A. Lewis, “Superresolution fluorescence near-field scanning optical microscopy”, Appl. Phys. Lett. 49, 674 (1986); M. Isaacson, E. Betzig, A. Harootunian, and A. Lewis, “Scanning optical microscopy at tenth wavelength resolution using near-field imaging methods”, Ann. N. Y. Acad. Sci. 483, 448 (1986); E. Betzig, M. Isaacson, A. Lewis, and K. Lin, “Near-field scanning optical microscopy”, Proc. 45th Annual Meeting of the Electron Microscopy Society of America, G.W. Bailey, Ed., 184 (1987); E. Betzig, M. Isaacson, and A. Lewis, “Collection mode near-field scanning optical microscopy”, Appl. Phys. Lett. 51, 2088 (1987); A. Lewis, E. Betzig, A. Harootunian, M. Isaacson, and E. Kratschmer, “Near-field imaging of fluorescence”, in Spectroscopic Membrane Probes, Vol. II L.M. Loew, Ed., 81 (CRC Press, 1988); E. Betzig, M. Isaacson, H. Barshatzky, A. Lewis, and K. Lin, “Near-field scanning optical microscopy (NSOM)”, Proc. Soc. Photo-Opt. Instrum. Eng. 897, 91 (1988); E. Betzig, M. Isaacson, H. Barshatzky, A. Lewis, and K. Lin, “Superresolution imaging with near-field scanning optical microscopy (NSOM)”, Ultramicroscopy 25, 155 (1988); E. Betzig, J.K. Trautman, T.D. Harris, J.S. Weiner, and R.L. Kostelak, “Breaking the diffraction barrier: optical microscopy with nanometric resolution”, Science 251, 1468 (1991); E. Betzig, P.L. Finn and J.S. Weiner, “Combined shear force and near-field scanning optical microscopy”, Appl. Phys. Lett. 60, 2484 (1992); J.K. Trautman, E. Betzig, J.S. Weiner, D.J. DiGiovanni, T.D. Harris, F. Hellman, and E.M. Gyorgy, “Image contrast in near-field optics”, J. Appl. Phys. 71, 4659 (1992); E. Betzig, J.K. Trautman, J.S. Weiner, T.D. Harris, and R. Wolfe, “Polarization contrast in near-field scanning optical microscopy”, Appl. Opt. 31, 4563 (1992); E. Betzig, J.K Trautman, R. Wolfe, E.M. Gyorgy, P.L. Finn, M.H. Kryder, and C.-H. Chang, “Near-field magneto-optics and high density data storage”, Appl. Phys. Lett. 61, 142 (1992); E. Betzig and J.K. Trautman, “Near-field optics: microscopy, spectroscopy, and surface modification beyond the diffraction limit”, Science 257, 189 (1992); E. Betzig, “Principles and applications of near-field scanning optical microscopy”, in Near-Field Optics, D.W. Pohl and D. Courjon, Eds., 7 (Kluwer, Dordrecht, 1993); E. Betzig and R.J. Chichester, “Single molecules observed by near-field scanning optical microscopy”, Science 262, 1422 (1993); E. Betzig, S.G. Grubb, R.J. Chichester, D.J. DiGiovanni, and J.S. Weiner, “Fiber laser probe for near-field scanning optical microscopy”, Appl. Phys. Lett. 63, 3550 (1993); E. Betzig, R.J. Chichester, F. Lanni, and D.L. Taylor, “Near-field fluorescence imaging of cytoskeletal actin”, Bioimaging 1, 129 (1993); R.D. Grober, T.D. Harris, J.K. Trautman, and E. Betzig, “Design and implementation of a low temperature near-field scanning optical microscope”, Rev. Sci. Instrum. 65, 626 (1994); R.D. Grober, T.D. Harris, J.K. Trautman, E. Betzig, W. Wegscheider, L. Pfeiffer, and K. West, “Optical spectroscopy of a GaAs/AlGaAs quantum wire structure using near-field scanning optical microscopy”, Appl. Phys. Lett. 64, 1421 (1994); J.K. Trautman, J.J. Macklin, L.E. Brus, and E. Betzig, “Near-field spectroscopy of single molecules at room temperature”, Nature 369, 40 (1994); H.F. Hess, E. Betzig, T.D. Harris, L.N. Pfeiffer, and K.W. West, “Near-field spectroscopy of the quantum constituents of a luminescent system”, Science 264, 1740 (1994); S.K. Buratto, J.W.P. Hsu, J.K. Trautman, E. Betzig, R.B. Bylsma, C.C. Bahr, and M.J. Cardillo,“Imaging InGaAsP quantum well lasers using near-field scanning optical microscopy”, J. Appl. Phys. 76, 7720 (1994); S.K. Buratto, J.W.P. Hsu, J.K. Trautman, E. Betzig, R.B. Bylsma, C.C. Bahr, and M.J. Cardillo, “Near-field photoconductivity: Application to carrier transport in

InGaAsP quan- tum well lasers", Appl. Phys. Lett. 65, 2654 (1994); E. Betzig, "Proposed method for molecular optical imaging", Opt. Lett. 20, 237 (1995); J. Hwang, L.K. Tamm, C. Bohm, T.S. Ramalingam, E. Betzig, and M. Edidin, "Nanoscale complexity of phospholipid monolayers investigated by near-field scanning optical microscopy", Science 270, 610 (1995); L.K. Tamm, C. Bohm, J. Yang, Z.F. Shao, J. Hwang, M. Edidin, and E. Betzig, "Nanostructure of supported phospholipid monolayers and bilayers by scanning probe microscopy", Thin Solid Films 285, 813 (1996); G. Merritt, E. Monson, E. Betzig, and R. Kopelman, "A compact fluorescence and polarization near-field scanning optical microscope", Rev. Sci. Instrum. 69, 2685 (1998); E. Betzig, "Excitation strategies for optical lattice microscopy", Opt. Express 13, 3021 (2005); E. Betzig, "Sparse and composite coherent lattices", Phys. Rev. A. 71, 063406 (2005); E. Betzig, G.H. Patterson, R. Sougrat, O.W. Lindwasser, S. Olenych, J.S. Bonifacino, M.W. Davidson, J. Lippincott-Schwartz, H.F. Hess, "Imaging intracellular fluorescent proteins at nanometer resolution", Science 313, 1642 (2006); H. Shroff, C.G. Galbraith, J.A. Galbraith, H. White, J. Gillette, S. Olenych, M.W. David- son, E. Betzig, "Dual color superresolution imaging of genetically expressed probes within individual adhesion complexes", Proc. Natl. Acad. Sci. 104, 20308 (2007); N. Ji, J.C. Magee, E. Betzig, "High speed, low photodamage nonlinear imaging using passive pulse splitters", Nat. Methods 5, 197 (2008); S. Manley, J.M. Gillette, G.H. Patterson, H. Shroff, H.F. Hess, E. Betzig, J. Lippincott- Schwartz, "High density mapping of single molecule trajectories with photoactivated localization microscopy", Nat. Methods 5, 155 (2008); H. Shroff, C.G. Galbraith, J.A. Galbraith, E. Betzig, "Live cell photoactivated localization microscopy of nanoscale adhesion dynamics", Nat. Mathods 5, 417 (2008); H. Shroff, H. White, E. Betzig, "Photoactivated localization microscopy (PALM) of adhesion complexes", Curr. Protoc. Cell Biol. 41, 4.21.1 (2008); N. Ji, H. Shroff, H.N. Zhong, E. Betzig, "Advances in the speed and resolution of light microscopy", Curr. Opin. Neurobiol. 18, 605 (2008); D. Greenfield, A.L. McEvoy, H. Shroff, G.E. Crooks, N.S. Wingreen, E. Betzig, J. Liphardt, "Self-organization of the Escherichia coli chemotaxis network imaged with super-resolution light microscopy", PLoS Biol. 7, e1000137 (2009); D. Li, L. Shao, B. Chen, X. Zhang, M. Zhang, B. Moses, D.E. Milkie, J.R. Beach, J.A. Hammer, M. Pasham, T. Kirchhausen, M.A. Baird, M.W. Davidson, P. Xu, E. Betzig, "Extended-resolution structured illumination imaging of endocytic and cytoskeletal dynamics", Science 349, aab3500 (2015); N. Yamashita, M. Morita, W.R. Legant, B. Chen, E. Betzig, H. Yokota, Y. Mimori-Kiyosue, "Three-dimensional tracking of plus-tips by lattice light-sheet microscopy permits the quantification of microtubule growth trajectories within the mitotic apparatus", J. Biomed. Opt. 20,101206 (2015); J. Xie, M. Wooten, V. Tran, B. Chen, C. Pozmanter, C. Simbolon, E. Betzig, X. Chen, "Histone H3 Threonine Phosphorylation Regulates Asymmetric Histone Inheritance in the Drosophila Male Germline", Cell 163, 920 (2015).