



Stefan W. Hell



Date of Birth 23 December 1962

Place Arad, Romania

Nomination 2 April 2019

Field Physics

Title Professor. 2014 Nobel Prize in Chemistry

Most important awards, prizes and academies

Study of physics and doctorate University of Heidelberg (1990), postdoc EMBL Heidelberg (1991-1993), Senior Researcher University of Turku, Finland (1993-1996) and Visiting Scientist University of Oxford, UK (1994), German Habilitation in physics (University of Heidelberg, 1996), head of an independent research group (1997-2002) at the Max Planck Institute for Biophysical Chemistry, Director and Scientific Member at the Max Planck Institute for Biophysical Chemistry (since 2002), Head of the "Optical Nanoscopy" division of the German Cancer Research Center (DKFZ) Heidelberg (since 2003), Adj. Professor of Physics University of Heidelberg (2003), Honorary Professor of Experimental Physics University of Göttingen (2004).

ICO Prize of the International Commission for Optics (2000); Helmholtz Prize for metrology (2001); Carl Zeiss Research Award of the Ernst Abbe Fonds (2002); Berthold Leibinger Innovation Award (2002); Karl Heinz Beckurts Prize (2002); Gottlieb Daimler and Karl Benz Award of the Berlin-Brandenburg Academy of Sciences and Humanities (2004); Innovation Award of the German President (2006); Cozzarelli Prize of the Proceedings of the National Academy of Science, USA (2007); Julius Springer Prize for Applied Physics (2007); Gottfried Wilhelm Leibniz Prize of the German Research Foundation (2008); Lower Saxony State Award (2008); Otto Hahn Prize for Physics (2009); Doctor honoris causa med, University of Turku, Finland (2009); Ernst Hellmut Vits Prize (2010); Familie Hansen Prize (2011); Körber European Science Prize (2011); Gothenburg Lise Meitner Prize (2011); Meyenburg Prize for Cancer Research (2011); Science Prize of the Fritz Behrens Foundation (2012); Doctor honoris cause, Politehnica University of Bucharest, Romania (2011); Paul Karrer Medal (2013); Carus Medal of the Leopoldina Nationalen Akademie der Wissenschaften (2013); Kavli Prize in Nanoscience (2014); Nobel Prize in Chemistry (2014).

Summary of scientific research

Beginning in the 1980s, Hell wondered if the so-called Abbe limit could be surpassed. German physicist Ernst Abbe found in 1873 that the smallest distance that could be resolved under an optical microscope was about half the wavelength of the light observed. Thus, for visible light at the shortest possible wavelength of 400 nanometres (nm), features smaller than 200 nm would be blurred out, and many features of cells and microorganisms would be impossible to observe. Other methods, such as electron microscopy, achieve much higher resolutions, but at the cost of preparation methods that kill cells and microorganisms.

During his time at Turku, Hell devised a method for overcoming the Abbe limit through a modified form of fluorescence microscopy, in which molecules that fluoresce when excited by light are attached to very small structures and the resulting emission is observed. In Hell's technique—called stimulated emission depletion (STED) microscopy—one laser beam excites the fluorescent molecules, but another turns off the fluorescence except from a small area. The laser beams are moved over the specimen, and an image is gradually built up. When he returned to Germany, he and his group built a working STED microscope and in 2000 imaged yeast cells and *E. coli* bacteria with a resolution of about 100 nm. Since then, resolutions of less than 10 nm have been achieved, thus enabling the microscopic study of active viruses and of molecules in living cells.

Main publications

Uno, K.; Bossi, M.L.; Konen, T.; Belov, V.N.; Irie, M.; Hell, S.W.: Asymmetric diarylethenes with oxidized 2-alkylbenzothiophen-3-yl units: Chemistry, Fluorescence, and photoswitching. *Advanced Optical Materials* 7 (6), 1801746 (2019); Böhme, M.A.; McCarthy, A.W.; Grasskamp, A.T.; Beuschel, C.B.; Goel, P.; Jussyte, M.; Laber, D.; Huang, S.; Rey, U.; Petzoldt, A.G. *et al.*: Rapid active zone remodeling consolidates presynaptic potentiation. *Nature Communications* 10 (1), 1085 (2019); Belov, V.N.; Käfferlein, H.U.: Total synthesis of C-132,N-15-imidacloprid with three stable isotopes in the pyridine ring. *Journal of Labelled Compounds and Radiopharmaceuticals* 62(3), pp. 126-131 (2019); Bucevicius, J.; Keller-Findeisen, J.; Gilat, T.; Hell, S.W.; Lukinavicius, G.: Rhodamine-Hoechst positional isomers for highly efficient staining of heterochromatin. *Chemical Science* 10 (7), pp. 1962-1970 (2019); Butkevich, A.; Bossi, M.L.; Lukinavicius, G.; Hell, S.W.: Triarylmethane fluorophores resistant to oxidative photobleaching. *Journal of the American Chemical Society* 141 (2), pp. 981-989 (2019); van der Velde, J. H.M.; Smit, J.H.; Hebisch, E.; Punter, M.; Cordes, T.: Self-healing dyes for super-resolution fluorescence microscopy. *Journal of Physics D: Applied Physics* 52 (3), 034001 (2019); Farinacci, M.; Krahn, T.; Dinh, W.; Volk, H.D.; Düngen, H.D.; Wagner, J.; Konen, T.; von Ahsen, O.: Circulating endothelial cells as biomarker for cardiovascular diseases. *Research and Practice in Thrombosis and Haemostasis* 3 (1), pp. 49-58 (2019); Romach, Y.; Lazariev, A.; Avrahami, I.; Kleißler, F.; Arroyo-Camejo, S.; Bar-Gill, N.: Measuring environmental quantum noise exhibiting a nonmonotonic spectral shape. *Physical Review Applied* 11 (1), 014064 (2019)