



## Ahmed H. Zewail



Damanhour (Egypt), 26 February 1946 - Pasadena (USA), 2 August 2016

**Nomination** 3 September 1999

**Field** Physics and Chemistry

**Title** Professor, Nobel laureate in Chemistry, 1999

### Most important awards, prizes and academies

**Awards:** King Faisal International Prize in Science (1989); First Linus Pauling Chair, Caltech (1990); Wolf Prize in Chemistry (1993); Robert A. Welch Award in Chemistry (1997); Benjamin Franklin Medal, The Franklin Institute, USA (1998); Egypt Postage Stamps, with Portrait (1998); 'The Fourth Pyramid' (1999); Nobel Prize in Chemistry (1999); Order of the Grand Collar of the Nile, Highest Honor of Egypt, conferred by President Mubarak (1999); Ahmed Zewail Fellowships, University of Pennsylvania, USA (2000-); Ahmed Zewail Prize, American University in Cairo (2001-); Postage Stamp, issued by the country of Ghana (2002); Albert Einstein World Award (2006). **Academies:** Ahmed Zewail Center for FemtoScience & Technology, Korea (2002); Fellow, American Physical Society (1982); National Academy of Sciences, USA (1989); Third World Academy of Sciences, Italy (1989); St Catherine's College, Fellow, Oxford, UK (1991); Sigma Xi Society (1992); American Academy of Arts and Sciences (1993); Académie Européenne des Sciences, des Arts et des Lettres, France (1994); American Philosophical Society (1998); Pontifical Academy of Sciences (1999); American Academy of Achievement (1999); Royal Danish Academy of Sciences & Letters (2000); Fellow, American Association for the Advancement of Science, AAAS (2000); Honorary Fellow, Chemical Society of India (2001); Indian Academy of Sciences, Bangalore, India (2001); Foreign Member, Royal Society of London, UK (2001); Honorary Fellow, Sydney Sussex College, Cambridge, UK (2002); Foreign Fellow, Indian National Science Academy, New Delhi, India (2002); Honorary Foreign Member, Korean Academy of Science and Technology (2002); Honorary Fellow, African Academy of Sciences, Nairobi, Kenya (2002); Honorary Fellow, Royal Society of Chemistry, UK (2003); Foreign Member, Russian Academy of Sciences (2003); Foreign Member, Royal Swedish Academy of Sciences, Stockholm (2003); Foreign Member, Royal Academy of Belgium, Brussels (2003).

### Summary of scientific research

Current research is devoted to dynamical chemistry and biology, with a focus on the physics of elementary processes in complex systems. In the Laboratory for Molecular Sciences (LMS) Center, collaborative multidisciplinary research has been established to address the role of complexity in the primary function of real systems including enzyme catalysis, protein-RNA transcription, electron transport in DNA, and the role of water in protein and DNA recognitions. A major research frontier at LMS is the new development of ultrafast diffraction techniques that make possible the imaging of transient structures in space and time with atomic-scale resolution. A significant effort is also devoted to giving public lectures to enhance awareness of the value of knowledge gained from fundamental research, and helping the population of developing countries through the promotion of science and technology for the betterment of society.

### Main publications

*Physics & Chemistry - Ultrafast Electron Diffraction:* Thee, H., Lobastov, V., Gomez, U., Goodson, B., Srinivasan, R., Ruan, C.-Y. and Zewail, A.H., Direct Imaging of Transient Molecular Structures with Ultrafast Diffraction, *Science*, 291, p. 385 (2001); Thee, H., Cao, J. and Zewail, A.H., Ultrafast Electron Diffraction of Transient Fe(CO)<sub>4</sub>: Determination of Molecular Structure and Reaction Pathway, *Angew. Chem., Int. Ed. Engl.*, 40/8, p. 1532 (2001); Ruan, C.-Y., Lobastov, V.A., Srinivasan, R., Goodson, B.M., Thee, H. and Zewail, A.H.,

Ultrafast Diffraction and Structural Dynamics - The Nature of Complex Molecules Far from Equilibrium, *Proc. Natl. Acad. Sci.*, 98, p. 7117 (2001); Lobastov, V.A., Srinivasan, R., Goodson, B.M., Ruan, C.-Y., Feenstra, J.S. and Zewail, A.H., Ultrafast Diffraction of Transient Molecular Structures in Radiationless Transitions, *J. Phys. Chem. A*, 105, p. 11159 (2001); Zewail, A.H., The Uncertainty Paradox - The Fog That Was Not, *Nature*, 412, p. 279 (2001); Thee, H., Goodson, B.M., Srinivasan, R., Lobastov, V.A. and Zewail, A.H., Ultrafast Electron Diffraction and Structural Dynamics: Transient Intermediates in the Elimination Reaction of C<sub>2</sub>F<sub>4</sub>I<sub>2</sub>, *J. Phys. Chem. A*, 106, p. 4087 (2002); Goodson, B.M., Ruan, C.-Y., Lobastov, V.A., Srinivasan, R. and Zewail, A.H., Complex Landscapes of Molecular Structures Imaged by Ultrafast Electron Diffraction: Thermal and Light-Mediated Reactions, *Chem. Phys. Lett.* (2003); Srinivasan, R., Lobastov, V.A., Ruan, C.-Y. and Zewail, A.H., Ultrafast Electron Diffraction, (UED) A New Development for the 4D Determination of Transient Molecular Structures, Review Article, *Helvetica Chimica Acta*, June Special Issue, 1 (2003). *Biology - Protein and DNA Ultrafast Dynamics*: Wan, C., Fiebig, T., Schiemann, O., Barton, J.K. and Zewail, A.H., Femtosecond Direct Observation of Charge Transfer between Bases in DNA, *Proc. Natl. Acad. Sci.*, 97, p. 14052 (2000); Qu, X., Wan, C., Becker, H.-C., Zhong, D. and Zewail, A.H., The Anticancer Drug-DNA Complex: Femtosecond Primary Dynamics for Anthracycline Antibiotics Function, *Proc. Natl. Acad. Sci.*, 98, p. 14212 (2001); Pal, S.K., Peon, J. and Zewail, A.H., Ultrafast Surface Hydration Dynamics and Expression of Protein Functionality:  $\alpha$ -Chymotrypsin, *Proc. Natl. Acad. Sci.*, 99, p. 15297 (2002); Pal, S.K., Peon, J. and Zewail, A.H., Hydration at the Surface of the Protein Monellin: Dynamics with Femtosecond Resolution, *Proc. Natl. Acad. Sci.*, 99, p. 10964 (2002); Fiebig, T., Wan, C. and Zewail, A.H., Femtosecond Charge Transfer Dynamics of a Modified DNA Base: 2-Aminopurine in Complexes with Nucleotides, *J. Phys. Chem.*, 3, pp. 781-8 (2002); Yu, H.-Z., Baskin, J.S. and Zewail, A.H., Ultrafast Dynamics of Porphyrins in the Condensed Phase. II. Zinc Tetraphenylporphyrin, *J. Phys. Chem. A*, 106, p. 9845 (2002); Pal, S.K., Peon, J., Bagchi, B. and Zewail, A.H. (feature article), Biological Water: Femtosecond Dynamics of Macromolecular Hydration, *J. Phys. Chem. B*, 106, p. 12376 (2002). *World Affairs - Science, Public Education & Aiding the Third World*: Zewail, A.H., The New World Dis-Order - Can Science Aid the Have-Nots?, Proceedings of the Jubilee Plenary Session of the Pontifical Academy of Sciences, *Science and the Future of Mankind*, 99 (2000); Zewail, A.H., Science for the Have-Nots, *Nature*, 410, p. 741 (2001); Zewail, A.H., Dialogue of Civilizations: Making History Through New World Vision, *SSQ2/Journal*, Routledge Press (Paris, France, 2002), adapted from a public address at UNESCO, April 20, 2002; Zewail, A.H., *Dilemma of Science in the Developing World: Personal Reflections*, Third World Academy of Sciences Publication, 2003, based on Keynote Speech at the General Assembly of TWAS, New Delhi, October 22, 2002; Zewail, A.H., *Voyage Through Time - Walks of Life to the Nobel Prize*, American University Press (2002), two new editions and 17 translations into other languages; Zewail, A.H., Femtochemistry - Atomic-Scale Dynamics of the Chemical Bond using Ultrafast Lasers (Nobel Paper), *Angewandte Chemie*, Invited, International Edition, 39, pp. 2586-2631 (2000), German Edition, 112, pp. 2688-2738 (2000) Nobel Paper; A.H. Zewail, *Asr Al Álm* (Arabic), Dar Al Shorouk, Beirut-Cairo, 2005; appeared in the 7th edition since publication in June 2005; A.H. Zewail, *Al Zaman* (Time) Book Series, *Zewail Lectures* (Arabic), Dar Al Shorouk, Cairo, 2007; A.H. Zewail, *Hewar Al Hadarat* (Dialogue of Civilizations) Book Series, *Zewail Lectures* (Arabic), Dar Al Shorouk, Cairo, 2007; *Physical Biology: From Atoms to Medicine*, ed. A.H. Zewail, Imperial College Press, London, 2008.