William D. Phillips

Date of Birth 5 November 1948

Place Wilkes-Barre, PA (USA)

Nomination 7 April 2004

Field Physics

Title Professor, Nobel laureate in Physics, 1997

Professional address

Laser Cooling and Trapping Group,
Joint Quantum Institute
Quantum Measurement Division,
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National Institute of Standards and Technology
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Most important awards, prizes and academies

Awards: Gold Medal, Dept. of Commerce (1993); Michelson Medal, Franklin Institute (1996); Nobel Prize in Physics, shared with Steven Chu of Stanford University and Claude Cohen-Tannoudji of the École Normale Superieure, Paris (1997). *Nobel Prize Citation*: 'for development of methods to cool and trap atoms with laser light'. *Academies*: Fellow, American Physical Society; Fellow, Optical Society of America; Fellow, American Academy of Arts and Sciences; Pontifical Academy of Sciences.

Summary of scientific research

Recent scientific activities center on the manipulation of matter with light, and its applications. This includes laser cooling of atoms; trapping of atoms in laser, magnetic, and microwave fields; the study of Bose-Einstein condensation of cold atomic gases; the quantum motion of atoms trapped in optical lattices, including the study of interacting, degenerate gases in one, two and three-dimensions; the study of collisions between lasercooled atoms and between atoms in a BEC, including photoassociative spectroscopy and the precision determination of atomic lifetimes and scattering lengths; the use of lasercooled atoms in atomic frequency standards, including atomic fountain clocks; atom optics and atom lasers - the study of coherent atomic deBroglie waves and their use in devices like interferometers; microgravity applications of laser-cooled atoms, including atomic clocks and atomic interferometry; atom lithography - the use of atom optics to write patterns on surfaces; optical tweezers - the use of laser beams to manipulate biological cells and other small objects - for studies of biochemical binding, bioadhesion, and other biochemical and biomedical applications; and quantum information, in which cold atoms are used as qubits.

Main publications

Phillips, W.D., Strongly inhibited transport of a degenerate 1D Bose gas in a lattice, C. Fertig *et al.*, *Phys. Rev. Lett.*, 94, 120403 (2005); Laburthe Tolra, B., O'Hara, K.M., Huckans, J.H., Phillips, W.D., Roiston, S.L. and Porto, J.V., Observation of Reduced Three-Body Recombination in a Correlated 1D Degenerate Bose Gas, *Phys. Rev. Lett.*, 92, pp. 190-401 (2004); McKenzie, C., Hecker Denschlag, J., Häffner, H., Browaeys, A., de Araujo, L.E.E., Fatemi, F.K., Jones, K.M., Simsarian, J.E., Cho, D., Simoni, A., Tiesinga, E., Julienne, P.S., Helmerson, K., Lett, P.D., Rolston, S.L. and Phillips, W.D., Photoassociation of Sodium in a Bose-Einstein Condensate, *Phys. Rev. Lett.*, 88, pp. 120-403 (2002); Denschlag, J., Simsarian, J.B., Feder, D.L., Clark, C.W., Collins, L.A., Cubizolles, J., Deng, L., Hagley, E.W., Helmerson, K., Reirihardt, W.P., Rolston, S.L., Schneider, B.I. and Phillips, W.D., Generating Solitons by Phase Engineering of a Bose-Einstein Condensate, *Science*, 287, p. 97 (2000); Deng, L., Hagley, E.W., Wen, J., Trippenbach, M., Band, Y., Julienne, P.S., Simsarian, J.E., Helmerson, K., Roiston, S.L. and Phillips, W.D., Four-wave mixing with matter waves, *Nature*, 398, p. 218 (1999); Hagley, E.W., Deng, L., Kozuma, M., Wen, J., Helmerson, K., Rolston, S.L. and Phillips, W.D., A

Well-Collimated Quasi-Continuous Atom Laser, *Science*, 283, p. 1706 (1999); Kozuma, M., Den, L., Hagley, E.W., Wen, J., Lutwak, R., Helmerson, K., Rolston, S.L. and Phillips, W.D., Coherent Splitting of Bose-Einstein Condensed Atoms with Optically Induced Bragg Diffraction, *Phys. Rev. Lett*., 82, pp. 871-5 (1999); Phillips, W.D., Laser cooling and trapping of neutral atoms, *Rev. Mod. Phys*., 70, pp. 721-41 (1998)(Nobel Lecture); Kastberg, A., Phillips, W., Rolston, S., Spreeuw, R. and Jessen, P., Adiabatic cooling of cesium to 700 nK in an optical lattice, *Phys. Rev. Lett*., 74, p. 1542 (1995); Lett, P., Watts, R., Westbrook, C., Phillips, W.D., Gould, P. and Metcalf, H., Observation of Atoms Laser Cooled Below the Doppler Limit, *Phys. Rev. Let*., 61, p. 1169 (1988); Alan L. Migdall, John V. Prodan, William D. Phillips, Thomas H. Bergeman, and Harold J. Metcalf, First Observation of Magnetically Trapped Neutral Atoms, *Physical Review Letters*, 54, n. 24, pp. 2596-9 (June 17, 1985); William D. Phillips and Harold Metcalf, Laser Deceleration of an Atomic Beam, *Physical Review Letters*, 48, n. 9, pp. 596-9 (1982).