

Biography - Wolfgang Ketterle

Wolfgang Ketterle has been the John D. MacArthur professor of physics at MIT since 1998. He leads a research group exploring the properties of ultracold gases. His research is in the field of atomic physics and laser spectroscopy and includes laser cooling and trapping, atom optics and atom interferometry, and studies of Bose-Einstein condensation and Fermi degeneracy. A major focus is the exploration of new forms of matter, in particular novel aspects of superfluidity, coherence, and correlations in many-body systems. His observation of Bose-Einstein condensation in a gas in 1995 and the first realization of an atom laser in 1997 were recognized with the Nobel Prize in Physics in 2001 (together with E.A. Cornell and C.E. Wieman).

He received a diploma (equivalent to master's degree) from the Technical University of Munich (1982), the Ph.D. in physics from the University of Munich (1986). He did postdoctoral work at the Max-Planck Institute for Quantum Optics in Garching and at the University of Heidelberg in molecular spectroscopy and combustion diagnostics. In 1990, he came to MIT as a postdoc and joined the physics faculty in 1993.

His major accomplishments are the observation of Bose-Einstein condensation (BEC) in an atomic gas, the first realization of an atom laser, the development of important tools to manipulate and study Bose-Einstein condensates, and several seminal studies of the properties of Bose-Einstein condensates. During the early '90s, he and his collaborators developed techniques (a novel "dark" light trap, rf-induced evaporative cooling) which were crucial for the first observations of BEC both at Boulder (in rubidium, June '95) and at MIT (in sodium, Sept. '95). These observations led to a new subfield of atomic physics.

The new tools which his group developed for the study of BEC include the cloverleaf magnetic trap, dispersive imaging techniques for in situ and non-perturbative observation of BEC, the rf output coupler (which triggered the field of atom lasers), an optical trap to confine condensates and transport them over large distances, and the use of Bragg scattering as a tool for spectroscopy of a condensate. These techniques were used to explore the new physics of gaseous Bose-Einstein condensates. An interference experiment between two BECs provided the first direct evidence for the coherent nature and long-range correlations of a Bose condensate and established Bose condensates as coherent atom sources. Further important work includes studies of collective excitations in a condensate, the first measurement of the speed of sound, studies of spinor condensates, an exploration of the optical properties of a Bose-Einstein condensate, the discovery of superradiance of a condensate, a study of the formation process of the condensate, the first observation of Feshbach resonances, the realization of phase-coherent atom amplification, the study of vortex lattices, the realization of a Bose-Einstein condensate of fermion pairs, the observation of superfluidity in fermions (through quantized vortices), the study of superfluidity in imbalanced fermion systems, and the observation of itinerant ferromagnetism in a gas of fermions.

Wolfgang Ketterle is a fellow of the American Physical Society, the Optical Society of America, the American Academy of Arts and Sciences, the Institute of Physics (IOP), a member of the German physical society (DPG), the European Academy of Sciences and Arts, the Academy of Sciences in Heidelberg, the European Academy of Arts, Sciences, and Humanities, the Bavarian Academy of Sciences, the German Academy of Natural Scientists Leopoldina, a foreign associate of the National Academy of Sciences and a honorary member of the Deutsche Hochschulverband. His awards include a David and Lucile Packard Fellowship (1996), the Rabi

Prize of the American Physical Society (1997), the Gustav-Hertz Prize of the German physical society (1997), the Discover Magazine Award for Technological Innovation (1998), the Fritz London Prize in Low Temperature Physics (1999), the Dannie-Heineman Prize of the Academy of Sciences, Göttingen, Germany (1999), the Benjamin Franklin Medal in Physics (2000), the Nobel Prize in Physics (2001, together with E.A. Cornell and C.E. Wieman), the Medal of Merit of the State of Baden-Württemberg (2002), the Knight Commander's Cross (Badge and Star) of the Order of Merit of the Federal Republic of Germany (2002), the MIT Killian Award (2004) and a Humboldt research award (2009). He was selected Distinguished Traveling Lecturer of the Division of Laser Science of the American Physical Society (1998/99) and holds Honorary Degrees from Gustavus Adolphus College, St. Peter (2005), the University of Connecticut (2007), and Ohio State University (2007).