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Internet address: science@science-int.co.uk

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EDITORIAL

Molecule of the Year 1995

On rare occasions, the scientific community can relish a major advance, especially when it establishes the certainty of an honored but elusive hypothesis. This year's selection as Molecule of the Year, the Bose-Einstein condensate (BEC), proves a 70-year-old prediction by Albert Einstein and promises major challenges in physics as well as potentially important practical applications.

Since its inception in 1989, the Molecule of the Year feature has highlighted *Science*'s annual selection of the development it judges most likely to have major consequences for advancing science and providing societal benefits [*Science* **246,** 1541 (1989)]. The choice of the BEC broadens the scope of the selection process: The BEC is not a molecule, as are the previously selected buckyballs (1991), nitric oxide (1992), and p53 (1993), nor is it a process such as the polymerase chain reaction (1989), the manufacture of synthetic diamonds (1990), or the DNA repair enzyme system (1994).

Rather, the BEC is a long-hypothesized state of matter, derived from quantum theory, which defines the basic units of energy, light, and matter. Contributors to this work include the great pioneers of physics, from Planck, Bohr, and Einstein to de Broglie, Schrödinger, Heisenberg, Fermi, and Dirac. Once it was accepted that electrons behave both as individual particles and as waves, certain inconsistencies in atomic structure could be explained through mathematical formulations concerning those wave systems, that is, through quantum mechanics. Seventy years ago, Einstein built on these theoretical foundations to extend previous work by the Indian physicist S. N. Bose. Just as Einstein had predicted the existence of photons, the unit quanta of light, he now predicted the existence of a special set of atomic particles, bosons, that could be forced into a state in which they would have identical quantum properties [see *Science* **269,** 182 (1995)]. The existence of such a special state has been strongly inferred from phenomena such as the viscosity-free superfluidity of liquid helium, but its proof has been elusive. Earlier this year, scientists at the National Institute of Standards and Technology and the University of Colorado were at last able to validate the theory by documenting a Bose condensate of supercooled, magnetically trapped rubidium atoms. Their achievement is recognized as the beginning of a new era in condensed-matter and atomic physics.

In principle, many elements in the atomic table can exist in the BEC state. The implications for physics researchers and for society at large of the properties of this special state of matter are as yet undetermined. It has already been predicted that the BEC state can be used to create the atomic equivalent of lasers. Such lasers could permit the nanoscale sculpture of computer circuitry and perhaps other advances that are currently impossible.

The selection of the BEC as Molecule of the Year exemplifies the intellectual chain of progress that underlies virtually all of science: the interweaving of individual contributions on a worldwide scale and the emergence at certain key points of critical experimental data that give insight into old unknowns, generate important new questions, and provide new ways to create new products. The article on page (1902) of this issue by Contributing Correspondent Elizabeth Culotta, with the help of the News and Editorial staffs, describes the scientific background of the BEC discovery, the actual experiments, and related experiments reported by other groups. In addition, we offer a glimpse of research areas that are likely to make a splash in 1996, and a worldwide overview of a subject that has consumed many scientists' time this year—research funding. As in previous years, our article also lists nine runners-up: truly remarkable scientific achievements in fields ranging from astrophysics (a new planet), to biomedicine (genes to control development and metabolism), to the environment (evidence for global warming), to scientific communication (electronic journals and worldwide information sharing).

In 1995, *Science* also strode ahead. Our World Wide Web pages—which include a complete version of the Molecule of the Year package, plus selected references and hot links—have enhanced the value of our original research and news features by offering searching, browsing, and data display options impossible to achieve in ink, along with a new electronic communication channel dedicated to young scientists. We've put up sound; we've put up video; and we've provided links from our material to sites the world over. Next year the refinements will continue.

Floyd E. Bloom