chosen collective coordinate of the atomic cloud replaces the position of the end-mirror in the standard set-up. One of the benefits provided by this scheme is that there is no need to work hard to get to the ground state. In fact, in the direction along the cavity axis, the vibrational motion of the atoms is already in the ground state, at microkelvin temperatures. The atoms' vibrations have a rather low quality factor, but this is actually useful for observing measurement backaction, the central result of this work. These achievements point towards a potentially fruitful interplay of cold-atom physics with concepts known in nano- and optomechanics. Exciting avenues to be explored are the role of interatomic interactions (giving rise to truly collective modes) and the combination with atom-chip techniques.

Different as the two approaches[9,10] may be, they illustrate the rapid pace of progress in the young field of optomechanics. Breakthroughs such as cooling of massive objects to the ground state might, therefore, be just around the corner.

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KAVLI PRIZE

Science on all scales

How do you determine who does the best scientific research? For Fred Kavli — physicist, entrepreneur, philanthropist — the answer is clear: the most important science is that which benefits humanity. Established in 2000, the Kavli Foundation focuses on a few frontier areas of research that Kavli himself believes will make the largest impact on our quality of life. The Foundation funds endowed chairs as well as fifteen research institutes at top universities. And on 28 May 2008, the first recipients of the Kavli prizes in astrophysics, nanoscience and neuroscience were announced.

KAVLI FOUNDATION

On the smallest scale, the nanoscience prize went to Louis E. Brus of Columbia University and Sumio Iijima of Meijo University "for their large impact in the development of the nanoscience field of the zero and one-dimensional nanostructures in physics, chemistry and biology". Brus was working with colloidal suspensions of semiconductor particles when he noticed that the optical properties depended on their size and shape. These 'quantum dots' behave as artificial atoms with both fundamental and applied implications. Similarly, carbon nanotubes exhibit interesting physics and are useful for applications owing to their extraordinary strength. For his contribution to nanotube research, Iijima shares the nanoscience prize.

Further up the length scale is a single nerve cell, or neurone. In the human brain, each neurone is 'connected' to a thousand others, and there are 100 billion such neurones to coordinate. The circuitry is mind-boggling, but nonetheless, research has come a long way. Pasko Rakic of Yale University, Thomas Jessell of Columbia University and Sten Grillner of the Karolinska Institute were awarded the neuroscience prize "for discoveries on the developmental and functional logic of neuronal circuits". Rakic's work on neuronal development and Jessell's studies of neural circuitry have led to a framework for describing the assembly of neural circuits within the brain. Combined with the work of Grillner, mainly on the subtleties of motor coordination of nerve cells, we have a clearer understanding of the relationship between the structure and behaviour of the networks within the central nervous system.

Finally, at distances of billions of light-years from Earth are quasars. Through a small optical telescope, they are indistinguishable from local stars, and indeed, from their odd radio signals, they were considered to be 'quasi-stellar' objects in our Galaxy only fifty years ago. However, Maarten Schmidt of Caltech worked out that the spectrum of the quasar 3C273 only made sense if it was moving away at 47,000 km s^{-1} due to the expansion of the Universe. Consequently, it must be emitting 10^{12} times more energy than the Sun. The source of that power was eventually identified by Donald Lynden–Bell of Cambridge, building on the hypothesis of Edwin Salpeter and Yakov Zeldovich that quasars are powered by a central black hole. Lynden–Bell explained that the luminosity arose from frictional heating in the accretion disc surrounding a black hole. He also predicted that most massive galaxies harbour black holes, which has been verified. Schmidt and Lynden–Bell share the astrophysics prize for having "dramatically expanded the scale of the observable Universe [that has] led to our present view of the violent Universe in which massive black holes play a key role".

The three biennial prizes, jointly administered by the Norwegian Academy of Science and Letters, Norwegian Ministry of Education and Research, and the Kavli Foundation, each consists of a scroll, a medal and US$ 1 million. On 9 September 2008, the seven winners will collect their awards at the inaugural ceremony in Oslo, Norway. As public outreach is an important aspect of the Kavli prizes, the activities will include public-awareness lectures as well as scientific symposia.

May Chiao