Laser-cooled atoms, Heisenberg's Uncertainty Principle, and A Proposal of New Quantum-Mechanical Experiments

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Abstract:

According to Heisenberg's uncertainty principle, both, position and momentum of a particle, cannot be known with ultimate accuracy; the product: $\Delta x \,.\, \Delta p > h$. Whereas in the case of Laser-cooled atoms, we know that velocity of the particle is close to zero; and its position x is so perfectly known, that an atom is said to be held in Laser forceps. These experiments show that both position and momentum of atoms are accurately knowable! Similarly, when momentum of an atom is zero, the wavelength of its de Broglie wave is very very long; and according to quantum-mechanical interpretation, the atom is likely to be detected anywhere within its de Broglie wavelength, with higher probability at the peaks of the wave. Whereas the experiments with Laser-cooled atoms show that the atom is confined precisely within the Laser forceps. To avoid this anomaly, new experiment is proposed here in which, instead of quantum mechanical waves, which have wavelength $h / m v$, corresponding to phase velocity of the wave, we can let the waves corresponding to group-velocity, of the wavelength $h v / m c^2$, interfere in double-slit interference experiment. And we can expect that a particle may deterministically tunnel from one peak of the group-wave to next peak of the group wave; and can be detected at predictable points.

Detailed description will follow soon.