**Abstract**

Bose-Einstein condensates (BECs) could have a revolutionary impact in the fields of quantum logic and quantum computing, as well as the storage of optical information in a highly compressed state. BECs may possibly verify claims of quantum entanglement and engender profound implications related to the ability of humans to control atoms individually and usefully. If the power of Bose-Einstein condensates can be harnessed, the benefits would be wondrous. Quantum computing would give us the means to explore many statistical and probabilistic relationships, especially in the rapidly-expanding field of thermodynamics. To investigate, we must create a BEC using one of two techniques: magnetic confinement, or carbon dioxide lasers. From here, we must use lasers to trap light within the BEC and control the beam absolutely and microscopically. Absolute control of a BEC has not yet been achieved in the 13 years since their creation in 1995.

**What Is Currently Known about Bose-Einstein Condensates?**

- Complex laser-magnetic interaction systems are required to significantly cool a relatively large number of atoms to almost absolute zero. When rubidium atoms are used, they cannot be warmer than about 170 billionths of a degree above absolute zero.
- When cooled to almost absolute zero, a significant majority of the atoms in a Bose-Einstein condensate fall to the lowest possible quantum state and it becomes physically impossible to identify particular atoms because they all have exactly same properties. For this reason, a Bose-Einstein condensate is sometimes referred to as a single “super-atom” because it behaves as a whole and its parts are indistinguishable.
- A pulse of light in a vacuum becomes scaled by a factor of approximately six orders of magnitude, thereby compressing all of the information contained within it into a smaller space. From this, it immediately follows that applications in optical processing should be sought due to the efficiency that could be gained from such an endeavor.
- Inside of a Bose-Einstein condensate, light has been made to travel only 17 meters per second, which is around $5.66 \times 10^6$ times slower than its regular speed of travel in a vacuum at 3.00 $\times 10^8$ meters per second.

**References**


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