

# Manipulating Atoms with Light

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Understanding the nature of light and its interactions with matter has always been a challenge for Physics. New concepts have emerged from these investigations, such as the quantum nature of the microscopic world and the wave-particle duality. New mechanisms for the generation of light have also been discovered, leading to the realization of new light sources, called "lasers", with remarkable properties. The light emitted or absorbed by atoms is not only a valuable source of information on the structure of the world which surrounds us; it is also a powerful tool for acting on atoms, for manipulating them, for controlling their various degrees of freedom.

We will show how it is possible to use the basic conservation laws in atom-photon interactions for polarizing atoms, for cooling them to very low temperatures, in the microkelvin, and even in the nanokelvin range. A review will be given of recent developments in this field, including atomic clocks with atomic fountains, interference of atomic de Broglie waves, the realization of new states of matter such as Bose-Einstein condensates, matter waves and atom lasers. New perspectives opened by these results will be briefly discussed.