Perfect ring-shaped Bose-Einstein Condensates

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ABSTRACT

Bose-Einstein condensates (BECs) confined in ring-shaped geometries have attracted significant attention due to their unique properties and potential applications. We investigate the methods employed to create a stable ring-shaped BEC, including the use of time averaged adiabatic trapping potentials (TAAPs)[1] and precise control over cooling and confinement parameters. By such methods, a highly homogeneous and stable condensate can be achieved. Next, we look at the stability of the ring-shaped BECs by examining the effects of perturbation and fluctuations on its persistent currents and coherence. Through experimental measurements and theoretical analysis, we explore the conditions for the condensate to maintains its integrity and coherence, providing insights into the robustness of the system. Furthermore, we look at the dynamics of excitations within the ring-shaped[2] BEC, by introducing controlled manipulation of the trapping potentials, we investigate the behavior or response of the atoms within the condensate. The ring-shaped BEC presents a way to implement on mater wave interferometry and the very development of novel atom laser and in atomtronics[3]. The research is ongoing for further investigations into unique phenomena exhibited by ring-shaped BECs, paving the way for their potential impact across various scientific disciplines.

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