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Density engineering of an oscillating soliton/vortex ring in a Bose-Einstein condensate SHAHAR LEVY, ITAY SHOMRONI, ELIAS LAHOUD, JEFF STEINHAUER, Technion - Israel Institute of Technology — We study solitons in a Bose-Einstein condensate by engineering a density minimum on the healing length scale, using a far off-resonant laser beam. This results in a pair of counterpropagating solitons, which is the low collisional energy version of the celebrated matter wave interference pattern [M. R. Andrews et al., Science 275, 637 (1997)]. The solitons subsequently evolve into a pair of periodic soliton/vortex rings. We image the vortex rings and solitons in-situ on the healing length scale. This stable periodic evolution is in sharp contrast to the behavior of previous experiments in which the solitons decay irreversibly into vortex rings via the snake instability. The periodic oscillation between two qualitatively different forms seems to be a rare phenomenon in nature. We explain this phenomenon in terms of conservation of mass and energy in a narrow condensate.

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