Controlled Split-Recombination of 2D Matter-Wave Solitons in Time-Dependent Trap

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Abstract: We propose a novel approach to manipulate two-dimensional bright matter-wave solitons by tuning the frequency of the trap which is different from Feshbach resonance technique. The exact bright soliton solutions for two-dimensional Gross-Pitaevskii (GP) equation with attractive interaction strength in a time-dependent trap are constructed analytically and its dynamics show no collapse while modulating the trap frequency. The two-soliton dynamics exhibits an interesting splitting and recombination phenomenon which generates interference pattern in the process. This type of behaviour in two-dimensional BECs has wider ramifications and our approach opens new avenues in stabilizing bright solitons in higher dimensional regime. We have also explored the experimental realization of this novel phenomenon.