Engineering Dark Solitary waves in Ring-Trap Bose-Einstein condensates

D. Gallucci and N. P. Proukakis
Joint Quantum Centre (JQC) Durham-Newcastle, School of Mathematics and Statistics, Newcastle University, Newcastle upon Tyne, NE1 7RU, United Kingdom

1. Captions to movies

Fixed parameters throughout the movies.

Ring-trap:

- $\omega_\perp = 2\pi\, 600\,\mathrm{Hz}$
- $V_G = 31.5\, k_B\,\mathrm{nK}$
- $\mathbf{r_0} = 1.85\, l_0$
- $\omega = 0.95\, l_0$

Reference length unit: $l_0 = 10\,\mu\mathrm{m}$.
Density is given in units of l_0^{-2}.

Perturbation:

- $V_0/\mu = 2$
- $\sigma/\xi = 0.7$

MOVIES

1d.solitonic.avi: Renormalized density (top) and phase (bottom) profiles showing the mean-field evolution of density engineered counterpropagating solitary waves in a ring-trap (see Fig. A3 in the manuscript) in the 1d solitonic regime (see Fig. 3 in the manuscript). Gas parameters:

- $a_s = 1.1\mathrm{nm}$
- $l_r/\xi = 0.8$
- $N = 12200$
- $T = 0$

2d.solitonic.avi: Renormalized density (top) and phase (bottom) profiles showing the mean-field evolution of density engineered counterpropagating solitary waves in a ring-trap (see Fig. 4a in the manuscript) in the 2d solitonic regime (see Fig. 3 in the manuscript). Gas parameters:

- $a_s = 2.75$nm
- $l_r/\xi = 1.3$
- $N = 15600$
- $T = 0$

shedding.avi: Renormalized density (top) and phase (bottom) profiles showing the mean-field evolution of density engineered counterpropagating solitary waves in a ring-trap (see Fig. 4b in the manuscript) in the shedding regime (see Fig. 3 in the manuscript). Gas parameters:

- $a_s = 4.07$nm
- $l_r/\xi = 1.54$
- $N = 18600$
- $T = 0$

snaking.avi: Renormalized density (top) and phase (bottom) profiles showing the mean-field evolution of density engineered counterpropagating solitary waves in a ring-trap (see Fig. 4c in the manuscript) in the snaking regime (see Fig. 3 in the manuscript). Gas parameters:

- $a_s = 8.25$nm
- $l_r/\xi = 2.2$
- $N = 28200$
- $T = 0$

2d.solitonic.long.evolution.avi: Renormalized density (top) and phase (bottom) profiles showing the long-term mean-field evolution of density engineered counterpropagating solitary waves in a ring-trap (see Fig. 4a in the manuscript) in the 2d solitonic regime (see Fig. 3 in the manuscript). Gas parameters:

- $a_s = 2.75$nm
- $l_r/\xi = 1.3$
- $N = 15600$
- $T = 0$

2d.solitonic.T9nK.avi: Renormalized density (top) and phase (bottom) profiles showing the long-term stochastic dynamics of density engineered counterpropagating solitary waves in a ring-trap (see Fig. 6 in the manuscript) in the 2d solitonic regime (see Fig. 3 in the manuscript). Gas parameters:

- $a_s = 2.75$nm
- $l_r/\xi = 1.3$
- $N = 18700$
- $T = 9\,\mathrm{nK}$