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Controllable non-local bright solitons in dipolar condensates[1]
MATTHEW EDMONDS, THOMAS BLAND, NICK PARKER, Newcastle University — The recent achievement of condensation of atoms possessing significant magnetic dipole moments affords a new opportunity to explore the interplay of magnetic effects with the coherent nature of the condensate. The dipolar interaction introduces a non-local potential into the mean-field equation of motion for the condensate, leading to novel phenomena. The ability to precisely control the condensate's dimensionality and interactions by tuning the scattering length allows the creation and probing of long-lived bright solitary wave structures. In a recent work (1) dark solitary wave excitations were explored for repulsively interacting dipolar condensates. Here, we extend this analysis to cover the case of attractive atomic interactions, leading instead to bright soliton solutions. We numerically analyse the role the relative phase and velocity play in multiple soliton collisions in conjunction with the dipole-dipole polarization and interaction strength, observing novel bound states whose character depends dramatically on the relative phase between solitons.

(1) T. Bland, M. J. Edmonds, N. P. Proukakis, A. M. Martin, D. H. J. O'Dell, and N. G. Parker, *Phys. Rev. A* **92**, 063601 (2015).

[1]EPSRC

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