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Engineering Bright Matter-Wave Solitons of Dipolar Condensates
MATTHEW EDMONDS, Okinawa Inst of Sci & Tech, THOMAS BLAND, RYAN DORAN, NICK PARKER, Newcastle University — The ongoing interest in ensembles of ultracold matter possessing significant magnetic dipole moments has lead to new insight into these macroscopic magnetic systems; such as manifestation of droplet phases [1-3]. Here, we analyze the form and interaction of dipolar bright solitons across the full parameter space afforded by dipolar Bose-Einstein condensates, revealing inelastic soliton dynamics. From this, three collisional regimes emerge: free collisions, bound state formation and soliton fusion. We further examine the stability of these states by employing a three-dimensional variational analysis; along with regimes where the dipolar bright soliton is unstable to collapse or expansion, we identify regions of stability which are accessible to current experiments [4]. [1] H. Kadau, M. Schmitt, M. Wenzel, C. Wink, T. Maier, I. F.-Barbut, and T. Pfau, *Nature* **10**, 1038 (2016). [2] I. F.-Barbut, H. Kadau, M. Schmitt, M. Wenzel, and T. Pfau, *Phys. Rev. Lett.* **116**, 215301 (2016). [3] L. Chomaz, S. Baier, D. Petter, M. J. Mark, F. Wächtler, L. Santos, and F. Ferlaino, *Phys. Rev. X* **6**, 041039 (2016). [4] M. J. Edmonds, T. Bland, R. Doran, and N. G. Parker, arXiv:1610.01022 (*New. J. Phys.*, in press)

Matthew Edmonds
Okinawa Inst of Sci & Tech

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