

Few-boson systems with spin-orbit coupling in the presence of strong interaction

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We consider a few spin-1/2 bosons with strong contact interactions and spin-orbit coupling in one dimension and investigate the ground state and the energy spectrum. Some of us have reported that, in two particle systems with spin-orbit coupling, the ground state contains a significant amount of the anti-symmetric spin state in the presence of strong interactions [1]. Without spin-orbit coupling, spin-1/2 bosons keep the symmetry and are composed of only symmetric spin states. For instance, this fact enables one to use symmetrised collective spin operators. However, our two-particle results have indicated that is not the case if spin-orbit coupling is induced due to the emergence of the anti-symmetric spin state. We will show the properties of three- and four-particle systems in the presence of strong interactions. They disagree with some previous reports [2,3], and we will explain why.

References

- [1] A. Usui, Th. Fogarty, S. Campbell, S. A. Gardiner, and Th. Busch, *New J. Phys.* 22 013050 (2020).
- [2] C. Hamner, C. Qu, Y. Zhang, J. J. Chang, M. Gong, C. Zhang, and P. Engels, *Nature Comm.* 5, 4023 (2014).
- [3] J. Lian, L. Yu, J.-Q. Liang, G. Chen, and S. Jia, *Sci. Rep* 3, 3166 (2013).