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Observing spinon excitations in quantum spin models[1]

YING TANG, ANDERS SANDVIK, Boston University — We develop a technique to directly study spinons (emergent spin $S = 1/2$ particles) in quantum spin models in any number of dimensions [1]. Two characteristic lengths—the size of a spinon wave packet and the size of a bound pair (a triplon)—are defined in terms of wave-function overlaps that can be evaluated by quantum Monte Carlo simulations. We find that these two lengths are well distinguishable in one-dimensional models with valence-bond-solid (VBS) ground states and explicitly dimerized models, yet hardly separable in 2-leg ladder systems. We provide some physics insights for these phenomena. We also study spinons in two-dimensional resonating-valence-bond states and models with Néel-VBS transitions.

[1] Y. Tang and A. W. Sandvik, Phys. Rev. Lett. 107, 157201 (2011).

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