Detecting Bell correlations beyond two measurement settings with spin-f systems

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Bell correlations are named after physicist John Stewart Bell, who first described them in 1964. They refer to correlations between the outcomes of measurements, performed on particles sharing quantum state, that cannot be explained by any local hidden variable theory. Bell correlations play a crucial role in the development of quantum technologies, leveraging the unique properties of quantum systems to perform tasks beyond the capabilities of classical technologies, including quantum teleportation, quantum cryptography, and quantum computing. In some applications allowing multisetting Bell scenario which extends the standard one by considering multiple measurement settings per each observe might be profitable.

We explore detection of Bell correlations in spin-f Bose-Einstein condensates generated dynamically from coherent state with a focus on the role of measurement settings. We define protocols for certifying Bell correlations using a data-driven approach [1] for arbitrary numbers of settings. These Bell correlations are then verified using recent experimental results for spin-1 BECs [2]. Our results reveal the fundamental characteristics of the multisetting Bell scenario in spin-f bosonic systems.

References

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