SYMMETRY HOLES, WAVE FUNCTION SYMMETRY, INTERACTION AND STATISTICAL CORRELATION IN THE MOSHINSKY ATOM

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ABSTRACT. In this work, we analyze how the symmetry of the wave function and the interaction between particles influence the statistical correlation. We use the Moshinsky atom which is a model of two particles in a harmonic trap interacting through a harmonic potential. The strength of the trap is used to modulate the intensity of the interaction between particles. The study is carried out in position and in momentum space using tools from information theory. We found that the localization and magnitude of the statistical correlation in the anti-symmetric state relative to the symmetric one depends on the presence of an attractive or repulsive inter-particle potential. For certain non-interacting systems, the magnitude of the statistical correlation is equal for both types of symmetry. Turning on an attractive inter-particle potential yields that the correlation is greater in position space for the symmetric state while the anti-symmetric state is more correlated for a repulsive potential. In momentum space, the anti-symmetric state is more correlated with the attractive potential while it is the symmetric state which is more correlated with a repulsive potential. We also found crossover points which show that the relative order of the localization and statistical correlation in anti-symmetric and symmetric states can be tuned by varying the strength of the harmonic trap. These results give insights into the interplay between the inter-particle potential and symmetry holes and how these determine the statistical correlation between particles.

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