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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

Exploiting entanglement to detect axions

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Abstract:

We propose a new approach in the investigation and detection of axion and axion-like particles based on the study of the entanglement for two interacting fermions. Indeed, the evolution driven by axions--induced interaction between two identical spin $-1/2$ fermions induces a non-zero entanglement which detection is a proof of the existence of the axions. We show how it is possible to design the experiment to suppress the contribution to the entanglement of all other interactions. A particular care is devoted to the analysis of the contribution of the magnetic dipole--dipole interaction, that results to be the most relevant source of noise in our approach. We show that its contribution to the entanglement can be suppressed by setting opportunely the duration of the experiment. Moreover, to extend the range of validity of our approach, we introduce a two--body correlation function which can be directly observed in an experiment and plays the role of an entanglement witness.

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