Many-body tunnelling in a symmetric double-well potential

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Tunnelling is one of the most fascinating phenomena in quantum physics, whose implications on the dynamics of many-body systems are still unclear. Recently, it has been argued that the presence of inter-particle interactions in quantum many-body systems may lead to cooperative effects, such as the modification of the single-particle tunnelling (density-induced tunnelling) or the simultaneous tunnelling of a few particles as a single object through a potential barrier (cotunnelling). Under certain conditions, these additional non-standard Hubbard terms are considerably more important than previously assumed, due to correct account of the Wannier functions, which tails were neglected in many estimations. In this poster, we will examine some preliminary results about cooperative effects shown by a couple of particles in a double-well potential, under the effect of different types of interaction. Our results show that, under certain conditions, the non-standard cotunnelling process affects the dynamics of the system, which is slightly, but notably modified. Moreover, the non-standard density-induced tunnelling amplitude may suppress the single-particle tunnelling even for repulsive two-particle interactions. This would correspond to a bound state localized in one well, which cannot decay but only propagate between the wells due to the cotunnelling mechanism.