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Tracing a few-fermion system inside the unitary window

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We analyse the behaviour of few-fermion systems having $1/2$ spin-isospin symmetry close to the unitary limit, the limit in which the scattering length takes values much bigger than the typical length of the system. In the case of nucleons, the large values of the singlet and triplet scattering lengths locate the system naturally close to the unitary limit. Using a potential model with variable strength, set to give controlled values to the singlet and triplet scattering lengths and the triton binding energy, we study the spectrum of $A = 2, 3, 4, 6$ nuclei in the region between the unitary limit and their physical values. In particular we analyse how the values of the binding energies emerge from the unitary limit forming the observed levels. To this end we consider the system with and without the Coulomb interaction and with a without a three-body force paying particular attention to the four-fermion excited state.

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