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Mass Polarization in Three-Body System with Two Identical Particles

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Abstract : The mass-polarization term of the three-body kinetic energy operator is evaluated for different systems which include two identical particles: A+A+B. The term has to be taken into account for the analysis of AB- and AA-interactions based on experimental data for two- and three-body ground state energies. In this study, we present three-body calculations within the framework of a potential model for the kaonic clusters K−K−p and ppK−, nucleus 3H and hypernucleus 6 ΛΛHe. The systems are well clustering as A+ (A+B) with a ground state energy E2 for the pair A+B. The calculations are performed using the method of the Faddeev equations in configuration space. The phenomenological pair potentials were used. We show a correlation between the mass ratio mA/mB and the value δB of the mass-polarization term. For bosonic-like systems, this value is defined as δB = 2E2 − E3, where E3 is three-body energy when VAA = 0. For the systems including three particles with spin(isospin), the models with average AB-potentials are used. In this case, the Faddeev equations become a scalar one like for the bosonic-like system αΛΛ. We show that the additional energy conected with the mass-polarization term can be decomposite to a sum of the two parts: exchenge related and reduced mass related. The state of the system can be described as the following: the particle A1 is bound within the A + B pair with the energy E2, and the second particle A2 is bound with the pair with the energy E3 − E2. Due to the identity of A particles, the particles A1 and A2 are interchangeable in the pair A + B. We shown that the mass polarization δB correlates with a type of AB potential using the system αΛΛ as an example.

Keywords : three-body systems, mass polarization, Faddeev equations, nuclear interactions
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