Calculations of Triton Binding Energy with Lorentz Boosted Nucleon-Nucleon Potential

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There are two basic approaches to a relativistic formulation of the 3N problem. One is a manifestly covariant scheme linked to a field theoretical approach, the other is based on an exact realization of the symmetry of the Poincaré group in three nucleon quantum mechanics [1]. We employ the second approach, where the mass operator (rest energy operator) consists of relativistic kinetic energies together with two- and many-body interactions including their boost corrections [2].

The phase equivalent relativistic NN potential, which is related by a nonlinear equation [3] to the original nonrelativistic potential, is used to construct the mass operator (rest Hamiltonian) of the 3-nucleon system. Using some realistic NN potentials, the solution of the relativistic 3N Faddeev equation for ^{3}H shows slightly less binding energy than the corresponding nonrelativistic result. The effect of the Wigner spin rotation on the binding is very small.

Table 1: The theoretical predictions for the relativistic and nonrelativistic triton binding energies in MeV. All numbers are 34 channels results with CD-Bonn potential. The results in the third column take charge dependence into account. In addition the result of the fourth column contains also Wigner spin rotation effects.

	np force only	np+nn forces	Wigner rotation
nonrelativistic cal.	-8.247	-8.005	-
relativistic cal.	-8.147	-7.916	-7.914
difference	0.100	0.089	-

References

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