PP bremsstrahlung and low energy NN interaction

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Abstract

Bremsstrahlung is one of the simplest possibilities available to investigate the NN interaction at off-shell points. For the study of bremsstrahlung several microscopic models have been developed. Besides the inclusion of the negative energy states in a dynamical way, other refinements, like contribution from two body currents (meson exchange currents and the Δ isobar), are also possible. Despite this richness of included physics, these models are posed with problems; predictions differ substantially from experiment in some kinematical regions. It appears that this is mainly due to the high sensitivity of the bremsstrahlung process with respect to the NN interaction at low energies.

In the past nucleon-nucleon potential fitted to describe np scattering date, were used to describe processes like bremsstrahlung and a satisfactory agreement has been achieved. Once the high accuracy KVI bremsstrahlung experiments were performed, microscopical bremsstrahlung models using these np potentials were observed to fail describing the data in the above mentioned way. We will consider a field theoretical model of the NN interaction in the $^1S_0$ channel which also takes into account the Coulomb interaction. This model is then incorporated in a field theoretical toy model for bremsstrahlung. Phase shifts of the NN toy model are in good agreement with the experimental pp phase shift in the low energy region.

We end by presenting a fit of the NN potential of Fleischer and Tjon to the experimental pp phase shifts. Bremsstrahlung is then computed within the microscopic model of Martinus *et al.*. Although they are reduced, the discrepancies are still present. To remove them, a finer tuning of the potential and inclusion of pure Coulomb bremsstrahlung contributions may be needed.