TRANSITION E.M. FORM FACTOR IN THE MINKOWSKI SPACE BETHE-SALPETER APPROACH

V.A. Karmanov[(a)], J. Carbonell[(b)]

[(a)] Lebedev Physical Institute, Moscow, Russia
[(b)] Institut de Physique Nucléaire, Orsay, France

Obtaining the solutions of the Bethe-Salpeter (BS) equation in its original Minkowski space formulation [1] has raised an increasing interest in the recent years. The reason is that the Wick rotation and, hence, the Euclidean BS amplitude, are not directly applicable for computing electromagnetic (e.m.) form factors due to the existence of singularities in the complex momentum plane whose contributions are in general unknown. As a consequence, the knowledge of the BS amplitude in Minkowski space is required. Up to now, this quantity has been computed only using a separable approximation of the kernel [2].

A method based on the Nakanishi representation of the BS amplitude was developed (see for review [3]) allowing to compute the bound state Minkowski amplitude and the corresponding elastic e.m. form factors. Although this approach could be naturally extended to the scattering states, we found in a previous work [4] the scattering states in a different, more simple and more straightforward way. This solution provided the scattering length, elastic and inelastic phase shifts and, especially, the off-shell BS scattering amplitude.

In the present contribution, and using as input the bound and scattering BS amplitudes in Minkowski space, we calculate the transition e.m. form factor. It again requires a proper numerical treatment of the singularities associated to the propagators appearing in the triangle graph of the e.m. vertex. This is done in a way similar to ref. [4].

As output, we find the transition form factor vs. two variables: the momentum transfer and the final state energy. The final state interaction is taken into account by our Minkowski space solution for the off-shell BS amplitude.

We present here the first results for spinless particles. They open the way to more realistic calculations, in particular, for computing the deuteron electrodisintegration beyond separable approximation for the kernel.

[1] E.E. Salpeter, H. Bethe, Phys. Rev. **84**, 1232 (1951).

[2] S.S. Bondarenko, V.V. Burov, E.P. Rogochaya, Few Body Syst. **49**, 121 (2011); Phys. Lett. B **705**, 264 (2011); JETP Lett. **94**, 3 (2012).

[3] J. Carbonell, V.A. Karmanov, Few-Body Syst. **49**, 205 (2011).

[4] V.A. Karmanov, J. Carbonell, Proc. of FB20, Fukuoka Japan, 2012; to be published in Few-Body Syst; arXiv:1210.0925 (hep-ph); arXiv:1212.0846 (hep-ph).

E-mail: karmanov@sci.lebedev.ru