$2\nu\beta\beta$-Decay Nuclear Matrix Element with Inclusion of the Neutron–Proton Pairing and Particle Number Conservation

S. Kerrouchi[1,2]

[1]Ecole Nationale Supérieure de Technologie (ENST), Algiers, Algeria

[2]Ecole Nationale Préparatoire pour les Etudes de l'Ingéniorat (ENPEI), Algiers, Algeria

Theoretical interpretation of the $2\nu\beta\beta$-decay electroweak processes in nuclei requires a good description of nuclear many-body wave functions. Furthermore, it is well known that all $2\nu\beta\beta$-decay emitters are even-even nuclei and that the pairing interaction plays an important role in the structure of this kind of nuclei, therefore, it is expected that this interaction plays an important role in the evaluation of the nuclear matrix elements (NME) of double beta decay. Moreover, it is expected that the neutron-proton (np) pairing plays a significant role in this kind of transitions. However, np pairing is often treated within the BCS approach of which the non-conservation of the particle-number is the main shortcoming. The goal of our contribution is thus to evaluate the NME for the $2\nu\beta\beta$-decay in the BCS approach with inclusion of the isovector pairing interaction with particle-number conservation.

With this aim, the expressions of the NME for the $2\nu\beta\beta$-decay, which strictly conserve the particle-number, are first established, then, they are calculated for some transitions. The obtained results are compared, on the one hand, to values obtained before the projection, and on the other hand by considering only the pairing between like-particles.