

# Reliability of calculated nuclear matrix element of two-neutrino double- $\beta$ decay

*Tuesday, 18 June 2024 17:30 (2 hours)*

The nuclear matrix element (NME) of neutrinoless double- $\beta$  ( $0\nu\beta\beta$ ) decay is an essential theoretical input for determining the neutrino effective mass, if the half-life of this decay is measured. The NME is also necessary for the detector design for the next generation of the  $0\nu\beta\beta$  decay search. Reliable calculation of this NME has been a long-standing problem because of the diversity of the predicted values of the NME, which depends on the calculation method. A problem of the NME of the two-neutrino double- $\beta$  ( $2\nu\beta\beta$ ) decay of Xe-136 has been reported four years ago. The running sum for this NME of the shell model and the quasiparticle random-phase approximation (QRPA) were quite different. This means that the components of the NME are quite different depending on the calculations, and this problem affects the reliability of the predicted  $0\nu\beta\beta$  NME.

In my poster presentation, first, I clarify that the cause of the problem is not the theoretical differences of the shell model and the QRPA; this is seen from available examples. Second, I clarify that the cause is in the interaction strengths; this is shown by my calculations and analytical discussion. In particular, it is seen that a decreasing behavior of the running sum at the energy of the Gamow-Teller giant resonance indicates a larger interaction strength than that of other calculations with less or no decreasing behavior. It is also shown that my interaction strength is appropriate by comparisons with experimental data related to the double- $\beta$  decay.

## Poster prize

No

## Given name

Jun

## Surname

Terasaki

## First affiliation

Czech Technical University in Prague

## Second affiliation

## Institutional email

jun.terasaki@cvut.cz

## Gender

Male

## Collaboration (if any)

**Primary author:** TERASAKI, Jun (Czech Technical University in Prague)

**Presenter:** TERASAKI, Jun (Czech Technical University in Prague)

**Session Classification:** Poster session and reception 1

**Track Classification:** Neutrinoless Double Beta Decay