

UNIVERSITY OF NOTRE DAME  
DEPARTMENT OF PHYSICS

# NUCLEAR SEMINAR

Monday, April 18

## *Putting together the pieces of the puzzle for double beta decay*

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I will talk about efforts how to get information about the nuclear physics part involved in  $\beta\beta$  decay, here for both decay types, the two-neutrino and the neutrinoless decay. The nuclear physics input is generally given in terms of the "nuclear matrix element", and the nuclear matrix elements are presently the most critical items to estimate the decay rate of  $\beta\beta$  decay, in particular the one for the neutrinoless decay variant, which is the one proportional to the neutrino mass.

One piece of the puzzle can be obtained by charge-exchange reactions using hadronic probes. They give information about the Gamow-Teller (GT) strength distribution in the nucleus. Although these connect primarily to the two-neutrino type of  $\beta\beta$  decay, there are nuclear properties being unveiled, which are equally important for the neutrinoless decay. My show-case examples will be  $^{76}\text{Ge}$ ,  $^{100}\text{Mo}$  and  $^{136}\text{Xe}$ .

Another piece of the puzzle will be concerned with extending charge-exchange reactions to higher multipoles. I will show that hadronic processes may also be well suited for extracting the weak interaction  $2^-$  spin-dipole (i.e., first forbidden) strength distribution. The spin-dipole transition connects to the operator, which appears in the description of the neutrinoless  $\beta\beta$  decay.

Finally, I will describe a precision mass measurement performed with the JYFLTRAP system on the  $A=96$  triplet  $^{96}\text{Zr}$ ,  $^{96}\text{Nb}$  and  $^{96}\text{Mo}$ , where the single  $\beta$  decay  $Q$ -value of  $^{96}\text{Zr}$  has been at the center of attention. The  $^{96}\text{Zr}$  nucleus also undergoes  $\beta\beta$  decay, and I will show that the four-fold forbidden single  $\beta$  decay can provide one of the most direct tests to models aiming at a description of the neutrinoless  $\beta\beta$  decay.

**4 pm – 5 pm**

**Nuclear Science  
Laboratory**

**124 Nieuwland  
Science Hall**

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All interested  
persons are  
cordially invited  
to attend

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Refreshments will be  
served prior to the  
seminar in room 124