SuperNEMO Double Beta Decay Project

Supervisor: Dr Y. Ramachers, Experimental Particle Physics group

The EPP group at Warwick is part of the international SuperNEMO double beta decay collaboration. Over the last 10 years various neutrino experiments have shown that neutrinos oscillate between flavour states and therefore have a non-vanishing rest mass. However, as neutrino oscillation experiments probe the difference between neutrino mass states, the absolute mass scale is still unknown.

Another important unknown is the fundamental nature of the neutrino which could be either Dirac or Majorana, and the mechanism through which neutrino mass is acquired. Favoured by many theoretical models, the neutrino could be a Majorana particle acting as its own antiparticle and acquiring mass through the see-saw mechanism as opposed to the Higgs mechanism. A golden channel for answering both the question of neutrino nature and neutrino mass is neutrino-less double beta decay (see Figure 1, drawing on the right).

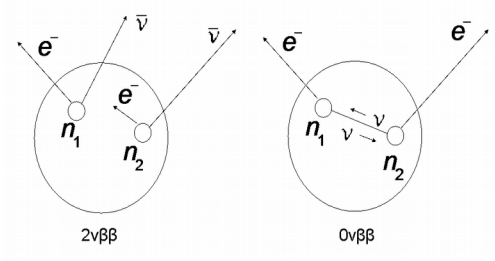
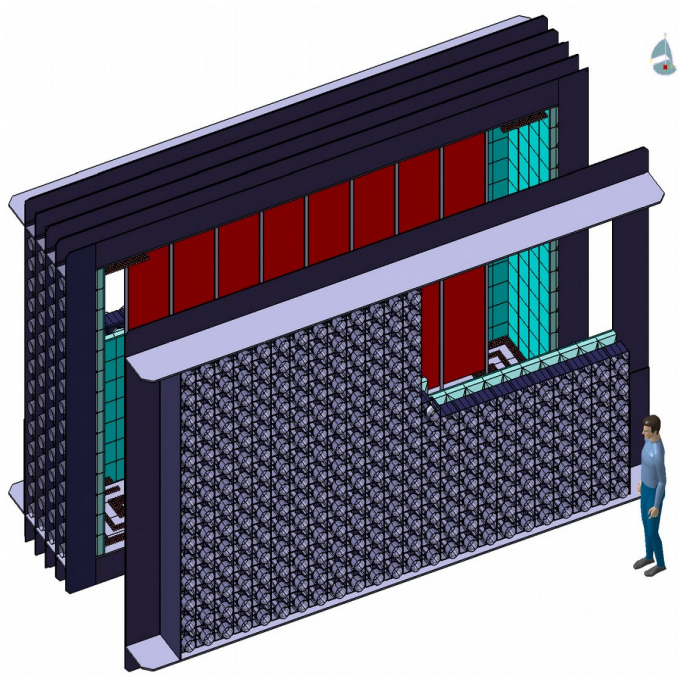


Figure 1: Schematic double beta decay, with and without neutrinos.

This advertised project would specifically benefit a student with computational and programming skills (Linux, C/C++ and/or Python). The SuperNEMO detector, see picture below, is a modern tracking detector, i.e. something rather unique among double beta detectors. The data consists of tracking and energy measurements. Warwick's main objective will be to contribute to the efforts into tracking data analysis and exploitation of the SuperNEMO demonstrator device. The collaboration currently finishes the demonstrator module construction, hence the demonstrator would be an interesting opportunity to test algorithms on real data as opposed to simulated data with corresponding physics analysis and outcomes. The environment at Warwick is well suited for data exploitation as the previous SuperNEMO collaboration Physics Coordinator would supervise the project and Warwick also hosts the software development coordinator.



You would receive postgraduate teaching from the Midlands Physics Alliance Graduate School on computing and programming as required and follow the regular postgraduate teaching courses on particle physics. Regular working visits to collaboration partners in London (UCL, Imperial) or Manchester can be planned. The demonstrator is located in the underground laboratory at Modane (in the Frejus tunnel), hence shift work in France during data taking might be expected.

For any further questions, please feel free to contact me directly (y.a.ramachers@warwick.ac.uk).