SEARCH OF NEW PHYSICS BEYOND THE STANDARD MODEL IN DOUBLE BETA DECAY

2 CFU

Teaching staff

Name Surname: Francesco Cappuzzello

Email: cappuzzello@lns.infn.it

Office: INFN-LNS, Via S. Sofia 64, Catania, Room 204/a

Reception hours: Friday 15:00-17:00

Program of the course:

Dirac equations and neutral fermions. Majorana fermions and neutrinos. Overview of early experimental evidences of neutrinos and neutrino properties. The search for $\beta\beta$-decay. Early geochemical experiments (the M.G.Inghram and J.H.Reynolds experiment). The $2\nu\beta\beta$-decay in the laboratory (the Elliott, Hahn and Moe experiment). Overview of present search of $2\nu\beta\beta$- and $0\nu\beta\beta$-decays. The Italian experiments at LNGS underground laboratory. Nuclear structure aspects of the $\beta\beta$-decays. The problem of Nuclear Matrix Elements. Surrogate nuclear reactions to study relevant nuclear response to isospin operators. Single Charge Exchange reactions and connection to single β-decay Fermi and Gamow-Teller nuclear transitions. The Double Charge Exchange reactions in connection with $\beta\beta$-decays. The NUMEN project at the INFN-LNS laboratory.

Bibliography:

- ✓ Scientific paper and slides provided by the teacher
- ✓ E. Segrè, "Nuclei e Particelle", Edited by Zanichelli
- ✓ F.T. Avignone III, S.R. Elliott and J. Engel, Reviews of Modern Physics **80**, 481 (2009)
- ✓ S. R. Elliott and M. Franz, Reviews of Modern Physics **87**, 187 (2015)
- ✓ M. Agostini, G. Benato, J.A. Detwiler, J. Menéndez and F. Vissani, Reviews of Modern Physics **95**, 025002 (2023)
- ✓ F. Cappuzzello et al. European Physics Journal A **54**: 72 (2018)
- ✓ H. Lenske, F. Cappuzzello, M. Cavallaro and M. Colonna, Progress in Particle and Nuclear Physics **109**, 103716 (2019)
- ✓ F. Cappuzzello et al. Progress in Particle and Nuclear Physics **128**, 103999 (2023)
- ✓ H. Ejiri, J. Suhonen, K. Zuber, Phys. Rep. **797**, 1 (2019)