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

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Teaching staff

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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. The case of the GERDA experiment. 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 ββ-decays. The NUMEN project at the INFN-LNS laboratory.

Bibliography:

E. Segrè, "Nuclei e Particelle", Edited by Zanichelli.

F. Avignone III, et al. Rev. Mod. Phys. **80**, 481 (2009)

S. Elliott, et al., Rev. Mod. Phys. **87**, 187 (2015)

F. Cappuzzello et al. Eur. Phys. J. A **54**: 72 (2018)

H. Lenske, F. Cappuzzello, M. Cavallaro and M. Colonna, Prog. in Part. and Nucl. Phys. (2019) in press, https://doi.org/10.1016/j.ppnp.2019.103716

H. Ejiri, J. Suhonen, K. Zuber, Phys. Rep. **797**, 1–102 (2019)