



UNIVERSITÀ
degli STUDI
di CATANIA

DIPARTIMENTO DI **FISICA E ASTRONOMIA**
“**ETTORE MAJORANA**”
DOTTORATO DI RICERCA IN **FISICA**
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Search of New Physics Beyond the Standard Model in Double Beta Decay

2 CFU

Teaching staff

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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 reaction 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:

E. Segrè, “Nuclei e Particelle”, Edited by Zanichelli.

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

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

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

H. Ejiri, J. Suhonen, K. Zuber, Phys. Rep. (2019) in press, <https://doi.org/10.1016/j.physrep.2018.12.001>