

## Investigation of Double Beta Decay of $^{116}\text{Cd}$ with the Help of Enriched $^{116}\text{CdWO}_4$ Crystal Scintillators

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Neutrinoless double beta decay ( $0\nu 2\beta$ ) is considered as a powerful tool to check physics beyond the Standard Model of particles. The nucleus  $^{116}\text{Cd}$  is one of the most promising for  $0\nu 2\beta$  experiments thanks to the high energy of the decay  $Q_{\beta\beta} = 2813$  keV, relatively large isotopic abundance 7.5%, availability of relatively cheap enrichment and promising theoretical calculations. The AURORA experiment aiming to search for  $2\beta$  processes in  $^{116}\text{Cd}$  with the help of two  $^{116}\text{CdWO}_4$  crystal scintillators (total mass 1.16 kg) enriched in  $^{116}\text{Cd}$  (to 82%) is in progress at the Gran Sasso underground laboratory (Italy) of INFN. High optical and scintillation properties of the crystals were obtained thanks to the deep purification of the initial materials, and the advantage of the low-thermal-gradient Czochralski technique for the crystal growth. The  $^{116}\text{CdWO}_4$  scintillators are highly radiopure ( $\sim 0.03$  mBq/kg of  $^{228}\text{Th}$ ,  $< 0.005$  mBq/kg of  $^{226}\text{Ra}$ ,  $< 0.3$  mBq/kg of  $^{40}\text{K}$ ). We have also observed a strong segregation of thorium, radium and potassium in the crystal growing process, which allows to improve substantially the radiopurity level of the  $^{116}\text{CdWO}_4$  scintillators. The two neutrino mode of the  $2\beta$  decay of  $^{116}\text{Cd}$  was investigated with the highest up-to-date accuracy resulting in  $T_{1/2} = [2.69 \pm 0.14(\text{syst.}) \pm 0.02(\text{stat.})] \times 10^{19}$  yr. Limit on  $0\nu 2\beta$  mode has been obtained as  $\text{lim} T_{1/2} = 1.9 \times 10^{23}$  yr at 90% C.L., which corresponds to the effective Majorana neutrino mass limit  $\leq (1.2 - 1.8)$  eV (depending on the nuclear matrix elements used). New limits on other double beta decay processes in  $^{116}\text{Cd}$  (decays with majoron emission, transitions to excited levels) were also obtained.